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RELATION OF TECHNICAL EDUCATION TO THE BUILDING INDUSTRY

THE White Paper on "Training for the Building Industry", which has been issued almost simultaneously with the report of the Central Council for Works and Buildings, indicates that in this matter the Government is proposing to act in accordance with the main principles of the Memorandum on Training and Recruitment for the Building Industry, prepared for the Ministry of Works and Buildings by Mr. G. D. H. Cole on behalf of the Nuffield College Social Reconstruction Survey in 1941. Though there is no mention of a guaranteed week, it is clear that the Government is prepared to deal with the difficulty of 'wet time' and by some system of guaranteed employment eliminate the casual form of engagement which was formerly the most unsatisfactory characteristic of employment in the industry. On the second major requirement laid down by Mr. Cole, it may well be held that in undertaking to give the industry a guarantee of employment at a high level for a period of at least ten years, the Government has fixed its target too high. The White Paper suggests that a post-war reconstruction programme designed for ten to twelve years will require the labour force in the building industry to be built up over a period to about 1,250,000 men. That figure has already been seriously challenged both in relation to the building programme itself and relative to the competitive demands on available man-power in Great Britain in the post-war period.

The report of the Central Council estimates that there will be a deficiency in Great Britain of about 275,000 skilled craftsmen, even on the assumption that all the fully trained men return to the industry, and for some years normal apprenticeship training will do little more than make good the wastage in the increased ranks of the expanded industry. This estimate is accepted in the White Paper, and the proposals made in the report for a system of special training of adults to meet this deficiency over a period of less than two and a half years are adopted.

It is accepted in the White Paper as a basic principle that the industry must participate fully in and be associated, both centrally and locally, with the administration of the schemes of special training to be provided by the Ministry of Labour and National Service and with the process of selection for training. To give effect to this principle, the Government proposes to establish a Building Industry Advisory Panel, over which the Minister of Labour and National Service or his deputy will preside, which will cover all relevant labour questions arising in the building programme. Under this Panel there will be a Special Training Committee to consider such matters as the number to be admitted to training over a given period, the proportion between different occupations, the methods of selection, the curriculum of training, the nature of the trade test and the standard of proficiency qualifying for admission to the industry. Local advisory committees attached to the employment exchanges will be set up to

assist in the selection of applicants for training, and full account will be taken of the special requirements and interests of the civil engineering as well as the building industry.

Besides this, the Government has adopted the major recommendation of the report and is prepared to establish without delay an Apprenticeship and Training Council for the building industry. This will be primarily representative of the industry, but will include representatives of other important interested bodies, as well as of all Government Departments concerned. It will be presided over by an independent chairman to be appointed by the Ministry of Works, and its primary function will be to observe and advise on all matters concerning the recruitment, education and training of young persons for the industry, both for craftsmanship and for management, and to encourage the development of craft apprenticeship schemes and student apprenticeship schemes on a comprehensive basis.

In addition to a comprehensive review of existing apprenticeship schemes, the definition of minimum standards to which approved schemes should conform, the maintenance of a register of apprentices in training under approved schemes and the issue of certificates on completion of training, the Council will naturally also have a close interest in the development of technical education for the industry, including pre-employment education and vocational training. It is agreed that the existing facilities for technical training in Great Britain, from the junior school level to the university, require careful survey in the light of the anticipated demands of the post-war expansion of the industry, and the Council should be able to make a valuable contribution in this field. It should also be able to assist as regards the training of instructors for technical education and of suitable entrants for the higher managerial posts in the industry.

The report itself makes detailed proposals for the constitution of the Council, and its fifty-one members should, it is suggested, include representatives of the Royal Institute of British Architects, the Institution of Civil Engineers, Institute of Builders, Institution of Structural Engineers, Institution of Municipal and County Engineers and others, and among the seven Government Departments specified is the Department of Scientific and Industrial Research. The chapter on technical education for building gives an able review of the present position, and suggests, first, that the industry has not yet made full use of the possibilities of the junior technical school and that the numbers involved are very small. The senior technical courses in building have likewise not been fully appreciated by the industry, and this in spite of the fact that the curricula provide a background of fundamental knowledge essential for those who are effectively to undertake supervisory and directive functions in the industry. University education in building has hitherto been almost entirely confined to architectural studies. In two universities only have courses leading to a degree in building science been established, but only that at Manchester is now in operation. Finally, in addition to the serious deficiencies in pre-employment education, both in the absence of facilities and of students, there is undue reliance on evening instruction; a primary need is for more day-time release. Evening education could provide rather for more advanced studies, which might be continued after the age of eighteen.

The proposals advanced in the report to remedy this situation are in striking harmony with those of the Nuffield College pamphlet "Industry and Education" (see NATURE, March 13, p. 287). First, an immediate increase in the facilities for junior technical school education in building in England and Wales and for trade-school education in building in Scotland is recommended, together with increased facilities for senior technical school education planned on a regional basis to serve the whole country. Secondly, the proposed Council should consider the early establishment of compulsory continuation education for young workers in the building industry between the school-leaving ages of fifteen and eighteen, even before such a system could be applied to all adults. A general system of reconstruction scholarships should be provided for students in the junior and senior technical schools and trade schools. In regard to curricula, it is suggested that half the time in the continuation schools should be devoted to vocational training and the remainder to physical training and to the fundamental studies in English and social subjects which are essential for effective citizenship in a modern democracy. Even the senior school courses should be broadened to include such subjects as current events, principles of citizenship, architectural and building history in relation to modern building, town and country planning, housing and economics in relation to problems of industrial management.

Thirdly, the report recommends that university courses in building should be developed and encouraged. This problem of facilitating a greater and more effective contribution by the universities to the development of this industry is in some ways the most difficult. The industry is not usually regarded by those outside as a profession for which they might reasonably prepare by university study, although those who have first-hand insight into the problems of modern scientific building are beginning to appreciate the value to the industry of men with the highest educational qualifications.

In the first place, the employment of university-trained men would meet the need for the increased control over materials which scientific research continues to bring about in ever-growing measure. The results of scientific research cannot be properly interpreted and applied except by one trained in the fundamental sciences and familiar with their technical application, no less than with the scientific methods of testing results. A sound knowledge of the fundamental sciences and their application to building should find as large a place in the education of the builder and of the architect. Once a regular avenue of entrance through the universities to the building profession has been established, men with this type of training and education should be invaluable in any large building projects; and their

services, properly utilized, would lead to a more scientific and more intelligent use of materials. Influx of men equipped with this type of education should also help to raise the general status of the industry and assist in setting up standards of qualification, on the absence of which the report comments.

Finally, apart from stressing the importance of attracting men of high standard, the report urges the necessity of attention to the provision of highly efficient instructors for the special training and other schemes, and to the need for meeting the prospective demands for men to fill the supervisory and managerial posts in the expanded industry. Special training schemes for men of these types will also be necessary, as well as a considerable expansion in the facilities available in technical colleges and similar institutions.

The proposals of this report, which represent a solution of this problem acceptable to influential representatives of both workers and employers, have a wide interest, apart altogether from the endorsement of their essentials by the Government in the White Paper. From the educational point of view they indicate that the building industry is coming to appreciate the dependence of industrial and commercial progress upon the availability and support of the right kind of technical education. This hope, expressed by Mr. W. O. Lester-Smith in his recent book "To Whom Do the Schools Belong?", like his further desire for closer co-operation between industry and education, is clearly in process of fulfilment, and the report on "Part-Time Day Education for the Adolescent" which has recently been issued by the British Association of Commercial and Industrial Education, describing the proceedings of a Conference at Rugby on September 29, 1942, affords further evidence in this direction.

What is most striking about the educational proposals, however, is their similarity with those advanced in the statement on "Industry and Education" referred to above, and to Dr. A. P. M. Fleming's address, "Education for Industry", to Section L at the British Association meeting at Dundee in 1939. The report on training for the building industry is clearly an application to the building industry of exactly those broad principles which are laid down in the Nuffield College paper. On the raising of the school age, the improvement of the quality of education at the earlier stages, the provision for continued part-time education—largely day-time education—the insistence on the limitations of evening classes, and the exclusion of vocational training from the common school, the report and the statement are expressing almost identical views. An even more forthright condemnation of the evening class system has recently been issued by the Association of Scientific Workers, whose *Journal* for February is devoted to education. Besides pressing for an extension of educational facilities, the *Journal* suggests that firms might make more use of their senior staffs as teachers.

The emphasis in all these statements on the necessity for a type of education which promotes adaptability, flexibility and mobility in the labour force as well as in management, the condemnation of the bias against manual occupations, and the refutation of the view that apprenticeship is obsolete or becoming obsolete, are encouraging signs. They demonstrate that industry and education are thinking of efficiency in no mere mechanical terms, as the references to the importance of wider cultural opportunities and the better and more instructed use of leisure also show. It is evident that industry is beginning to formulate more clearly its requirements, and to accept as its own responsibility the training of its recruits in a specialized technique.

Such plans, like those plans for education to which Sir William Jowitt had referred in his speech in the House of Commons at the end of last year on reconstruction, are put into their true perspective by the recent debates on economic policy. Whatever changes in our economy the War may enforce, Great Britain will still be dependent on imports of raw materials, but will be deprived of certain of the resources previously used to obtain them. The recognition of this position probably prompted several of the welcome references to scientific research and industrial efficiency in the economic debate, for we can only meet our requirements without lowering our standard of life by increased efficiency. It is indeed as a contribution to greater social and economic efficiency that the proposals of the Beveridge Report should be judged, however desirable they may be on other grounds.

The wisely planned development of the human resources, which are the ultimate source of all wealth and of success in reconstruction as well as of victory in war, is the one certain method of increasing efficiency that lies within our power. The stringency of the labour situation in Great Britain during the War has brought home to us the shortsightedness and neglect which has characterized our approach to the problem in the past, and it is well that education should be put in the forefront of a reconstruction programme. The reports of the factory inspectorate, the Select Committee on National Expenditure and the Industrial Health Research Board bear witness to our failure to pay due regard to the health and training of juvenile and adult workers, and to apply the experience so hardly acquired in 1914–18 as well as in the present War.

If the respective needs of industry and education can be met and harmonized, Great Britain can look forward to a period of rapid advance in both education and industry. The primary necessity, as the Nuffield College statement shows, is to improve the quality of labour and ensure an attitude to production which will inspire all those concerned with industry in an endeavour to raise productivity to the highest level. If labour is either inferior in quality or reluctant for any reason to give of its best, Great Britain's prospect of maintaining a high standard of living is poor indeed. Moreover, this requirement is powerfully reinforced by the existing age-structure of the British people. The scarcity of juvenile labour imposes on the nation the imperative obligation to improve its quality, both as producers and as citizens, to the highest possible point.

The proposals for training for the building industry must clearly be interlocked with the wider proposals for education in Great Britain to which the Government is already committed, and especially the raising of the school-leaving age. Quantitatively at least, the proposals are also linked with the magnitude of the building programme, and this forms an integral part of the general programme for reconstruction. They provide a further reason for urging the Government to declare its broad policy and initiate the enabling legislation within the framework of which co-ordinated and concerted action can be taken to deal with problems that are urgent, without risk of impeding or jeopardizing wider plans or projects which must await the conclusion of hostilities before they can be executed.

FRANKLIN'S EXPERIMENTS AND OBSERVATIONS ON ELECTRICITY

Benjamin Franklin's Experiments

A new edition of Franklin's "Experiments and Observations on Electricity". Edited, with a Critical and Historical Introduction, by I. Bernard Cohen. Pp. xxviii+453. (Cambridge, Mass.: Harvard University Press; London: Oxford University Press, 1941.) 22*s*. 6*d*. net.

THE Harvard University Press and Mr. Cohen have performed a very useful service in making Franklin's "Experiments and Observations" accessible in this convenient form. Mr. Cohen has written an introduction comprising chapters on Franklin and science, electricity before Franklin, Franklin's work in electricity and on the editions of Franklin's book. It is intended to serve both as an introduction to the text and as a study of Franklin as a man of science. It gives evidence of much research and fulfils its purpose admirably.

It is interesting to learn that Franklin's experimental work in electricity was not begun until he was forty years old. He was then in a position to retire from business, and he hoped to be able to devote himself to science. But this hope was not to be realized, for in a very few years public affairs made such demands on his time that he had to give up his electrical experiments. In this he acted in accordance with the view expressed in a letter which he had written in 1750. "Had Newton been Pilot but of a single common Ship, the finest of his Discoveries would scarce have excus'd or atton'd for his abandoning the Helm one Hour in Time of Danger; how much less if she carried the Fate of the Commonwealth". He seems almost to the end of his long life to have cherished the hope of having leisure some day to resume his researches.

Mr. Cohen in his introduction gives a critical account of the various editions of Franklin's book. "Experiments and Observations on Electricity, made at Philadelphia in America, by Mr. Benjamine Franklin, and Communicated in several Letters to Mr. P. Collinson, of London, F.R.S." was first published in 1751. A second part followed in 1753 and a third in 1754, both again consisting mainly of letters from Franklin to Collinson; the third part included papers by Canton and by Colden. The three parts appeared in second and third editions. In fourth and fifth editions (1769 and 1774), both personally supervised by Franklin, the three parts were published in one volume and much additional material was included. It is the fifth edition that forms the basis of the book now published. The supplementary part ("Electrical and other Philosophical Letters and Papers") has not been reproduced in full, but only in a selection confined mainly to 'electrical' letters and papers.

It is interesting to notice that on the title-pages of the fourth and fifth editions, Franklin's name is followed by the letters F.R.S. He had been elected a fellow in 1756. He had already been awarded the Copley Medal in 1753. In announcing this award, on November 30, 1753, the president of the Royal Society referred to the recipient as having "deserved well of the Philosophical World, and of this learned body in particular; to whom he has at various times caused to be communicated many of the Experiments he has made". He goes on to make a very just assessment of the value of Franklin's work on the electrical nature of lightning: "though some others might have begun to entertain suspicions of an Analogy between the effects of Lightning and Electricity; yet I take Mr. Franklin to be the first who, among other curious discoveries, undertook to show from experiments, that the former owed its origin entirely to the latter; and who pointed out an easy method, whereby anyone might satisfy himself of the truth of the fact which he had so advanced". It is somewhat surprising, as Mr. Cohen points out, that he makes no reference to Franklin's invention of the lightning conductor.

Franklin's book (in its fourth and fifth editions) begins with a short letter to Collinson dated March 28, 1747. In this Franklin writes, "Your kind present of an electric tube, with directions for using it, has put several of us on making electrical experiments, in which we have observed some particular phenomena that we look upon to be new. . . . I never was before engaged in any study that so totally engrossed my attention and my time as this has lately done". In his second letter, dated July 11, 1747, he gives a remarkably good account of "the wonderful effect of pointed bodies both in drawing off and throwing off the electrical fire". In the same letter he introduces the terms positive and negative, or plus and minus, to describe the two ways in which a body may be electrified. On September 1 of the same year, in his third letter to Collinson, he makes "a few observations on M. Muschenbroek's wonderful bottle". Among these we find: "At the same time that the wire and top of the bottle &c. is electrised positively or plus, the bottom is electrised negatively or minus, in exact proportion: i.e. whatever quantity of electrical fire is thrown in at the top, an equal quantity goes out at the bottom".

In "Additional Papers", sent with a letter to Collinson dated July 29, 1750, Franklin, after describing experiments on the discharging power of points, writes: "may not the knowledge of this power of points be of use to mankind, in preserving houses, churches, ships &c., from the stroke of lightning, by directing us to fix on the highest parts of these edifices, upright rods of iron made sharp as a needle, and gilt to prevent rusting, and from the foot of these rods a wire down the outside of the

building into the ground. . . . To determine the question whether the clouds are electrified or not, I would propose an experiment where it may be done conveniently". Then follow directions for carrying out the experiment on some high tower or steeple with pointed iron rod and "a kind of sentry box" to protect the observer.

The experiment suggested by Franklin was first carried out in France, on May 10, 1752, sparks being drawn as a thundercloud passed overhead from an insulated iron rod forty feet high which had been erected by D'Alibard for this purpose at Marly. D'Alibard's delightfully graphic description of the successful outcome of the experiment, read three days later to the Academie Royale des Sciences, was reproduced by Franklin in the fifth edition of his book, and is thus included in the present publication. In a letter to Collinson written in October 1752, he refers to the success of the "Philadelphia experiment" in Europe and describes his kite experiment. His observations were later made with an iron rod passing into his house. By September 1753, he was able to conclude "That the clouds of a thunder-gust are most commonly in a negative state of electricity, but sometimes in a positive state. . . . So that for the most part, in thunder-strokes, it is the earth that strikes into the clouds, and not the clouds that strike into the earth".

Some of Franklin's experiments must have been designed mainly for the entertainment of himself and his friends; some of these would appear to us now as highly dangerous: "The knocking down of the six men was performed with two of my large jars not fully charged. I laid one end of my discharging rod upon the head of the first; he laid his hand on the head of the second; the second his hand on the head of the third, and so to the last, who held, in his hand, the chain that was connected with the outside of the jars. When they were thus placed, I applied the other end of my rod to the prime-conductor, and they all dropped together."

Franklin's interest in branches of physics other than electricity may be exemplified by a quotation from a letter written in 1752. "I am not satisfied with the doctrine that supposes particles of matter, called light, continually driven off from the sun's surface, with a swiftness so prodigious! . . . May not all the phenomena of light be more conveniently solved, by supposing universal space filled with a subtile elastic fluid, which, when at rest, is not visible, but whose vibrations affect that fine sense in the eye, as those of air do the grosser organs of the ear? We do not, in the case of sound, imagine that any sonorous particles are thrown off from a bell, for instance, and fly in strait lines to the ear; why must we believe that luminous particles leave the sun and proceed to the eye?" It is with something of a shock that we read later in the same letter: "The chymists have analysed sulphur, and find it composed, in certain proportions, of oil, salt, and earth; and having by the analysis, discovered those proportions, they can, of those ingredients, make sulphur".

The quotations which have been given may perhaps serve to give some idea of the fascination of Franklin's book. Mr. Cohen has been able to add much of interest regarding both the book itself and Franklin's helpers and correspondents. In its present convenient and pleasant form "Experiments and Observations on Electricity" is sure of a wide welcome.

C. T. R. WILSON.

NATIONAL VIGOUR AND THE TEMPERATE ZONE

Climate and the Energy of Nations

By S. F. Markham. Pp. 144. (London: Oxford University Press, 1942.) 10s. 6d. net.

A FEATURE of the human race is the relation of a very constant body temperature to well-being, and that well-being is at its best when the environment is sufficiently lower in temperature to allow of the loss of heat at about the same rate as that at which it is generated, a loss in ensuring which evaporation takes a considerable share. When indoor temperatures are between 60° and 76° F. and relative humidities are between 40 and 70 per cent, men work better than if conditions are outside those limits. Exact figures would vary from country to country according to clothing, to long habituation to heating systems, and temperatures and humidities in general; a certain amount of breeze and of variability of atmosphere is clearly also important. Observations on solar radiation are inadequate, but it seems evident that too much ultra-violet light as well as too little sunlight can be a hindrance to healthy efficiency.

Major S. F. Markham, M.P., makes great play with the 70° F. isotherm, along or near which in the dry regions of the Old World are found the greater civilizations prior to 600 B.C., civilizations which used opportunities to build up populations fairly adequate for defence. The humid areas of that temperature lagged behind. Probably, in this matter, the primary distribution of cereals is important; they are plants of south-west Asiatic origin. Greece and Rome are a little on the cooler side of the 70° F. isotherm and it is probable that they had rather more moisture and perhaps rather lower temperature in the classical period (the early sub-Atlantic phase of climatologists) than now. The additional moisture would be a help, but Markham emphasizes the spread of the hypocaust and of public baths, and, on the other hand, thinks the Greek population was inadequate and too much inclined to limit privilege to citizens. The public baths of Rome, for social and moral reasons, came under Christian condemnation, and the transfer of the capital and aristocracy to Constantinople was another of the multitudinous factors of decline.

The chapter on Islam and the Arabs could have been enriched by consideration of the thought of Ibn Khaldun, much too neglected in western Europe. Islam at any rate advanced in a period that seems to have been a little warmer and more arid than the Classical age in the regions concerned. Just as he refers to the hypocaust in connexion with Classical civilization, so the author emphasizes the development of chimneys and grates in western Europe from the fourteenth century onwards, with the accompaniment, in due course, of windows and wooden floors in draught-proof houses.

It is significant that Markham is deeply impressed by the doctrine that politics is a function of the birth-rate; but while he deals with this statistically, he is in the dark, as are we all, about some of the physiological factors involved alongside the economic influences which bring out all too clearly the influence of the scramble up the social ladder. The ascription of low infant mortality to national vigour and intelligence is perhaps a little overdone when one reflects on the immense possibilities of infection where the summer is really warm. The relationship suggested between climate and general level of life in

south-east and north-west England respectively needs a whole book on historical geography for its treatment, but I do recall Sir John Russell's dictum that architecture varies broadly in England and Wales inversely as the rainfall. Perhaps it would have been better to leave out the short reference to the Jews; they are surely far from a "homogeneous race".

If a few reserves have here been indicated, this does not imply any condemnation of a thoughtful and highly suggestive book, which one welcomes all the more because it comes from a man who has been, and is, immersed in public affairs. Darwin's greatest thesis, as is not enough recognized, is that forms of life and their environments are ever acting and reacting on one another and must be studied together. If such studies, from many points of view, could be multiplied, the storms on the military and political horizon would soon diminish; we should understand, where now we so often dogmatize. H. J. FLEURE.

COAL SCIENCE AND TECHNOLOGY

Coke Formation Process and Physico-Chemical Properties of Coals

By Prof. W. Swietosławski. (Polish Institute Series No. 1.) Pp. viii+145+3 plates. (New York: Polish Institute of Arts and Sciences in America, 1942.) n.p.

PROF. W. SWIETOSŁAWSKI is well known in the realms both of pure science and of coal technology, and his new monograph describing the work of the Warsaw Institute of Technology will be welcomed in both fields. The volume appears to be the first publication of the Polish Institute of Arts and Science in America, and as such has an additional appeal in representing a real effort to save the results of scientific work in Poland from the effects of the War.

The researches upon coal of this well-known Polish man of science have been familiar to workers in this field for many years. His scientific papers have been particularly interesting in that the author has always made a special effort throughout to apply to this difficult subject the principles and technique of physical chemistry. It is most gratifying that he should have been spared to continue his work, and particularly that he has been able to preserve enough of the results of his researches as to produce so interesting a monograph. In the translation of his work into English he has been assisted by Prof. Matejczyk and, although in some places the construction may be a little strange, the general result is very clear and understandable. It is unfortunate that the illustrations were not made bolder—some of the graphs are difficult to read and the details of sketches are difficult to follow—but perhaps wartime conditions are responsible.

The preface to the book is by Prof. H. L. Olin of the State University of Iowa, where Prof. Swietosławski has presented his theories on the physical chemical properties of coal in a series of lectures.

The subject-matter of the monograph, although based upon personal researches, has a strong theoretical and speculative bias which is distinctly provocative in pointing out further lines of research not yet fully explored. The author does not give a full bibliography of the subjects on which he touches—it would have been unwise to attempt this in so short a volume—but limits himself to certain of the more widely known researches which bear upon his own theories.

Starting with the first subdivision of coal by Stopes into characteristic and recurrent physical forms, the author devotes the first chapters to discussion of the general physical properties of coal, including sorptive properties, ignition temperatures, and in particular the phenomena associated with the softening of coal under the influence of heat and the agglutination which results in coke formation. All these are discussed in terms of the Institute's researches, and only in a very few cases is reference made to, or comparison with, the work of other authorities; for example, in connexion with ignition temperatures, there is no comparison with the findings of Burrows Moore. Also, there is a tendency to attach too much importance to the interpretation of Foxwell's work. It is an interesting theory regarding the behaviour of coal blends on heating that 'activation' takes place with weakly caking coal, which makes the particles of this coal tend to reject agglomeration with those of the caking coal.

Chapters 5–10 describe in detail the behaviour of coals on heating, beginning with a theoretical study of 'melting phenomena' in individual coals, but particularly with the conditions which obtain when briquetted blends are heated through the stage of plasticity. The theories expounded are based on the examination of coals from different parts of the world and are in general those normally accepted in Great Britain. They are novel in their method of presentation, but the novelty lies more in their expression than in the theories themselves.

It is interesting to read that at Warsaw the Coal Division did not hesitate to translate its researches into larger-scale practice in order that they should not be confused by the effect of scale. This was done particularly in connexion with the carbonization of briquettes and the development of a two-stage carbonization process which involved the erection of special retorts. In principle, the process is not dissimilar from that of Parr's method of coking coal which is deficient in caking power. It is noteworthy, however, that the author has been misled by small-scale phenomena in the briquetting of coal under pressure but without a binder into thinking that preheating alone would liberate a binding material within the coal which would make a strong briquette. Actually this is not the case on a large scale, since larger briquettes retain their heat internally to such an extent that gasification continues after the briquette is made, and the structure of the briquette is ruptured by internal pressure.

The last three chapters of the book are more practical in their outlook and relate mainly to the two-stage process of coking coal, and coal blends, and coal-pitch blends, and to the description of a proposed new process in which the author postulates two stages of heating on the lines of Parr's work.

The book is printed and presented in a pleasing style, and although the sequence seems a little disconnected in places, the arrangement into paragraphs makes for easy reading and gives the author freer scope in his development of the theoretical side of his thesis.

In conclusion, one may express the hope that still more books of this valuable character may follow this first effort by the Polish Institute of Arts and Sciences in America. J. G. KING.

RESTARTING AGRICULTURE IN DEVASTATED EUROPE*

By SIR JOHN RUSSELL, F.R.S.

NEVER before in the whole history of mankind could the people of Europe have had to endure such appalling sufferings as have befallen the occupied countries during the past three years. Poland, Belgium and Greece have suffered especially severely, but the other occupied countries only little less. Even the official rations are inadequate, often supplying only about half to two thirds our standard requirements of calories, and in the case of Jews even less. But the official rations are by no means always forthcoming and the position would be desperate but for the operations of what the Germans call the 'black market'—mainly a device for hoodwinking them. Recent refugees bring acounts of widespread and growing malnutrition and deficiency diseases, children crippled by lack of essential foods, adults suffering from acute forms of tuberculosis, widespread malaria, typhus and other diseases: almost worse still, the populations crushed and made listless by hunger, and rapidly sinking to a condition when they can no longer take much part in rebuilding their shattered lives.

Along with this increasing inability to recover, there has been an appalling destruction of the material means for recovery. The Germans have taken whatever they wanted, and as they are driven out of the different countries they will almost certainly destroy everything possible. Agriculture is largely thrown out of gear: the systems of farming and the rotations are upset. Transport, the twin sister of agriculture, is being utterly disorganized: ships, barges, railway engines, trucks and lorries are being destroyed as quickly as they can be found.

Further, there have been forced deportations of masses of people who will want to be returned to their homes as soon as possible after the war: some eleven or twelve millions are said to be affected.

Modern Germany has certainly achieved the desolation on its borders that Caesar tells us the ancient Germans desired ("De bello Gallico", IV, 3, 2).

A new factor has come into play with which it is by no means easy to deal. During the War, the art of propaganda has been developed to a remarkable degree, and we may be sure that after the War the Germans will make every effort to stir up trouble wherever there are difficulties of recovery. Even after the War of 1914–18, when the methods were crude and undeveloped, trouble was created in eastern Europe; this time the danger will be greater. We must face the fact that the post-war problems will be at least as difficult as those of the War itself.

The first need will be to send in food, and this must be done immediately the Germans are expelled from any region. The need will be so great that the utmost efficiency of distribution will be essential. The Nutrition Committee of the Allied Post-War Requirements Bureau under the chairmanship of Dr. E. F. Penrose, economic adviser at the American Embassy in London, has worked out suited basic rations. Another committee under Dr. Melville Mackenzie is working out methods to cope with the post-war diseases and epidemics.

* Royal Institution discourse delivered on March 5.

Steps will be taken to assure supplies of food, but they could not possibly continue indefinitely and it will be imperative to restart the agriculture of Europe at the earliest possible moment in order first to augment and later to replace the efforts of the relief organization.

The numerous agricultural problems involved are dealt with by the Agricultural Committee of the Inter-Allied Post-War Requirements Bureau (of the Ministry of Economic Warfare). This Committee includes representatives of all the occupied countries as well as of the Dominions and the United States, and I have the honour to preside.

The Crops Needed

From what is known of the food conditions in the occupied countries, it seems certain that the most serious shortage is in calories. Until these are available there is no point in supplying more vitamins; indeed, we are told that vitamins without calories might do more harm than good. Immediately possession of the land is obtained it will be necessary, therefore, to sow crops capable of yielding high calorie returns per acre: the easiest and quickest to grow are cereals and potatoes. Pulses will be almost equally necessary to make up deficiencies of protein, for meat is likely to be scarce. The requisite cultivation can be quickly done by tractors if they can be shipped across, but the seed cannot be quickly produced; it must be saved from the crop of the preceding year. Provision of seed has, therefore, to be made beforehand. The position will be so serious that no avoidable risks can be taken; it will be imperative that the seeds sent into any particular region shall, both as to crop and to variety, be suitable to the soils and the climate. These are largely out of our control and we have to adapt ourselves to them.

Now it so happens that in all the occupied countries the Germans have extended the growth of the calorie-producing crops, cereals and potatoes. If the War should end by the autumn of 1943, the harvest of grain and potatoes would, so far as it remained intact, furnish seed for 1944, and much of the difficulty of calorie supply would thenceforward disappear. But if the War continues until the spring of 1944, much of the 1943 harvest will have been eaten or destroyed and the sowing programme will be more complicated. In any event, the supply of cereal and pulse seed must come mainly from the region itself; only in this way can one be sure of getting varieties suited to the conditions. In consequence, the first grain harvest after taking possession will have to be requisitioned by the Government of each country, and a corresponding amount of grain supplied for food. This will simplify enormously the difficulties of transport. Grain for seed must be selected with great care; the germinating capacity must be good; the varieties must be properly chosen and delivered always to the right localities at the right time, and there must be no mixing of varieties *en route*. But for food grains none of these precautions are needed: one variety can serve as well as another, and germinating capacity is unimportant. There will, however, certainly be regions where war operations have led to destruction or consumption of what should have been saved for seed, or where normal supplies are unobtainable; for these some provision from outside sources must be made.

A list of minimum seed requirements has been

drawn up, based on the assumption that requisitioning can supply 90 per cent of the seed grain. It includes more than half a million tons of grain seed, mostly wheat and rye—this is only a tenth of the actual requirement—also 11,000 tons of pulse seed, 425,000 tons of potato seed, 20,000 tons of seed for fodder crops, and 27,000 tons of lupins and seradella seed, chiefly for green manuring though some is used for fodder; the weight of vegetable seed required is much smaller though its importance is very great. The total is more than a million tons. The shortages are likely to be very unequal: France is normally an exporter of seed and may lack little beyond wheat and potato seed. Greece, on the other hand, will probably be very short of all seed, of wheat, pulses, potatoes and vegetable and fodder crops. Poland is likely to lack rye, wheat and other cereal and pulse seed, but perhaps not potato or sugar beet seed, though seed of beetroot—so important in Polish cookery—will probably be needed. Czechoslovakia and Jugoslavia will probably lack every kind of seed, and Belgium also. Denmark and the Netherlands may be better off.

How can all these demands be met? It is, of course, imperative that varieties be suitable: sources of supply must be selected where the climatic conditions are similar to those of the regions for which the seed is intended. Something can, let us hope, be drawn from Germany, Italy and Hungary, which normally supplied seeds to neighbouring countries. Sweden, a producer of high-quality pedigree cereal seed, could supply Norway, Denmark and Poland; Great Britain can furnish wheat, oat and potato seed to Holland, Belgium, France and parts of Poland, also some spring-sown cereal seeds to Norway, and seeds of vegetables and fodder crops to various countries; North Africa could supply wheat to France and Greece; Turkey could supply wheat, barley and oat seed to Greece.

Potato seed is likely to cause trouble: the only countries with any to spare may be the United Kingdom, perhaps also the Netherlands and Poland, unless the hunger in that tortured country becomes too great. But the storage of potato seed needs care, and disease may spread in the Continental stocks, in which case the United Kingdom becomes the sole reserve.

In all probability it will be necessary to go farther afield. North America can do something, but its climatic regions differ so greatly from those of Europe that only few similar regions can be found for winter crops, though it might do better for spring crops. Eastern Canada could supply autumn wheat seed to Poland, spring oats to Czechoslovakia, peas to Norway, also peas and haricots to Greece. The United States could provide some cereal, fodder crop and pulse seed to Czechoslovakia and Jugoslavia, and perhaps most of the Greek requirements. The Argentine could also supply wheat seed to Greece. There still remain difficult questions of transport; and, of course, the tragedy is that Europe was normally not merely self-sufficing for most seeds, but also had a large export trade.

Livestock Problems

Much more difficult problems will be presented by livestock. Before the War, Europe was comfortably well off for livestock—farm animals, without counting poultry, were nearly as numerous as human beings. In the occupied countries there were in the aggregate 44 million cattle, 34 million sheep, 10 million goats, 27 million pigs, and 10 million horses; 125 million in all for a human population of 137 millions. The numbers of cattle and of pigs generally ran in the same order as the numbers of human population: in most countries, as in the average of all, there was one head of cattle to three or four human beings, and one pig to about five: Denmark had more, having a very large export of dairy produce and bacon, and Greece had less but made up with sheep and goats. The numbers in Great Britain corresponded with these when allowance is made for the fact that we provided only about 40 per cent or less of our food. This similarity of cattle population would not mean similar standards of life. Western European countries imported far more feeding stuffs than Poland and the Balkan countries, and so had a much larger margin for themselves, even after the export demands were satisfied.

The population of horses was not quite in the same order as the human population or the numbers of cattle and pigs. Poland stood highest, partly because of the great importance the Government attached to cavalry, partly also because the peasants much loved horses, and always aspired to be able to drive to church on Sundays in a two-horse and not a one-horse vehicle, with two good horses, not poor ones. Jugoslavia used many horses for transport; Danish farmers loved horses and preferred them to tractors even though the tractors might work more quickly, while Greece used horses for transport and in addition had a considerable number of mules and donkeys.

Cattle are of special importance because they supply three vital necessities: milk, meat and motive power on the farm, but they do not all serve all these purposes. The breeds of cattle in Europe fall into two main groups: the peasant types and the good estate types. The peasant types have been evolved by survival: they are hardy and can live on very rough food and they are fairly resistant to tubercle and to insect-borne diseases. They usually have to serve several purposes: milk, reproduction and work during their active life, and in later life for meat and for leather. These peasant types are very localized: the Polish red cattle, for example, are scarcely to be found outside Poland, though a few, such as the Simonthal, are fairly widespread in Europe; practically none, however, is found outside Europe.

The good-estate types of cattle, on the other hand, are much more specialized, and have been evolved by careful selection, usually for one purpose only, or at most combining only meat and milk production. They give more milk than the peasant types though it may be less rich in butter-fat; the meat types also produce more meat; but they are never used for work. They are less hardy than the peasant sorts, usually more susceptible to tubercle and insect-borne attacks, and more exacting in the matter of food. Certain breeds have spread widely: the Frieslands, for example, are now found all over Europe, but usually on good-sized farms.

Sheep also serve several purposes: milk, reproduction, wool and meat, though even the peasant sorts do not work. But sheep are not closely related to the human population. They occur in high densities in two regions: Great Britain (which is easily first), and south-eastern Europe. The explanation is that sheep fit in very well with intensive cropping systems as adopted in Great Britain; but

they are also more suited than other animals to the poor conditions of hill countries.

It is impossible to form any close estimate of the present numbers of livestock, but piecing together the fragmentary information available it appears that by the middle of last year the loss of cattle alone was probably not less than eleven million head—nearly one and a half times the total cattle population of the United Kingdom, or a quarter of the pre-war cattle population. The losses had apparently fallen heaviest on Greece and Poland; so far as could be judged, their numbers were down by about a third or a half. Denmark appeared to have suffered less than most of the others.

It is certain that the position has deteriorated a good deal since the middle of last year. Moreover, these figures, grave as they are, do not tell the whole story. It is the best animals that have gone. Many of the survivors are immature and consequently of less production value; they are not as well-fed as in peace-time and so the yields of milk and of meat have fallen more than is indicated by the fall in numbers. The fall in milk yield has been estimated at 35 per cent; that is, some 3,500 million gallons—more than two and a half times the total production of England and Wales. The loss of sheep has been as great as the loss of cattle over the whole area; that is, about 11 million head; but it has fallen with peculiar harshness on the people of Greece and of Jugoslavia, where sheep were important as the source of milk.

The loss of pigs has been even heavier: by the middle of last year the total numbers in the occupied countries were down by at least 12 million—half the pre-war total—and the fall is certain to be greater now. Denmark, the Netherlands, Belgium and Luxembourg appear to have suffered worst. In most of the occupied countries pigs were the chief source of animal fat; their heavy fall in numbers means a drastic curtailment of calorie supplies.

The reduction in horse population has also been severe owing to heavy requisitioning for the German Army. By the middle of last year, the numbers were estimated down by about three or four million, that is, some 35–40 per cent over the whole occupied region, but the Netherlands had suffered even greater loss, which means, of course, that the working of the farms has become correspondingly more difficult.

Poultry have suffered most of all; by the middle of last year the numbers were only about one quarter the normal, and the position is certainly worse now.

Restoration of the animal population will be slow and laborious, and cannot be attempted until food supplies are in sight: one of the mistakes made after the War of 1914–18 was to send animals before the food was ready for them, and so they simply had to be slaughtered. After food for the animals is assured, milch cattle must be among the first to be increased so as to start making up the very great shortage of milk. Something can be done by supplying more and better food to the surviving animals, for the output of milk increases, up to a point, with the increase in food supply. But this will not suffice. Importation of live animals would be a solution if it were practicable. There may, and we hope there will, be a certain amount of disgorgement from Germany both of pedigree and of utility animals that have been taken from the occupied countries. Hungary may be able to supply one of the peasant breeds, the Simonthal, which is used both in Czechoslovakia and Jugoslavia; Switzerland also may have some to spare and also another peasant breed, Montafon. It is improbable that much of anything movable will remain in Italy after the War, but two Italian breeds, Reggio and Romania, would be useful in Greece. Movements of cattle within the continent of Europe would be easier than importation from overseas. But it seems unlikely that we can reckon on much from Europe; any immediate increase in Europe's cattle population could come only from overseas. Peasant breeds are unobtainable in this way, but good useful Friesians and Ayrshires could be drawn from Canada and the United States; it is not possible to say how many, but even if the figure is put at one million—which would be high—it still replaces only a fraction of the total loss. But there is the further difficulty of transport. A cargo boat of the ordinary 5,000–8,000 ton size could carry some 600 or 700 head of cattle, so that more than 1,500 journeys would be needed to transport our hypothetical million animals.

It seems safe to assume, therefore, that the re-establishment of the herds of milking cattle must come mainly from natural increase. But that is a very slow business: it takes at least two years to produce a new dairy cow, and only half the calves born are females. Cows vary widely in their capacity to yield milk, and it is well known that this quality is derived from the bull. So, from the outset, bulls with a good record of high-yielding daughters should be selected for replenishing the herds: the United Kingdom could supply some of these. Fortunately, the modern method of artificial insemination enables good bulls to be used very economically and to produce numbers of good-yielding calves from animals they have never seen: the bulls can be kept at control stations and the semen distributed by motor-car or by aeroplane over a large number of farms. In view of its importance, courses of instruction in the method have been arranged and attended by veterinarians selected by the different occupied countries, so that they can organize its wide adoption directly they get home. It would be possible to keep the bulls in Great Britain and dispatch the semen by air to the different centres, but it would be more convenient to establish centres in the different countries and to keep carefully selected bulls there. This would, of course, involve importation of the live animals, for which the necessary priority would have to be arranged.

But however carefully it is done, it seems unlikely that the cattle population of Europe can be restored in less than about six years. During the whole of this time, dried milk and other dairy produce will have to be sent into Europe.

The restoration of the horse population will take much longer because the difficulties are greater. Germany could restore any requisitioned horses that survive: the United States could probably supply Percherons if transport was available. Artificial insemination is of much less help than for cattle. Little addition to the total numbers can be expected during the first five years after the War, and full restoration to pre-war numbers may take some fifteen or sixteen years. During the first years it will be imperative to do much cultivation by tractor, though, as every farmer knows, the tractor does not altogether replace the horse for general farm work.

Under good conditions the sheep population should

recover more rapidly than the cattle, but in poor and hard conditions such as will certainly obtain in south-eastern Europe, recovery is bound to be slow; it has been estimated as at least nine years.

Pigs, however, multiply much more quickly; a good sow can produce and rear ten or fifteen piglets in a year; in spite of the drastic reduction we need not assume more than two years as the time needed for restoration to pre-war numbers. Not only are pigs by far the most prolific of all the larger farm animals, but they are also the most economical in their conversion of food into meat and fat, both of which will be urgently needed in Europe after the War. The case for the pig would be irresistible but for the unfortunate circumstance that, of all the animals on the farm, pigs are most like ourselves in food requirements: they take grain, potatoes, skim milk, fish and meat; they thus stand in sharp contrast with sheep and cattle, which take grass, straw and other coarse fodders of no use to us. So when human food is scarce pigs are not encouraged, or at least not beyond what can be fed on waste materials unfit for human consumption.

The same difficulty arises in the case of poultry, which are even more prolific than pigs, for under good management one hen may produce large numbers of chickens in a year. But again the food required is largely the same as for human beings, and so in spite of their value as producers of high-class protein, and tragically enough, in spite of the great need of high-class protein, it will not be possible greatly to encourage poultry-keeping, at any rate until the human food position becomes clearer. It will, however, be essential to furnish the peasants with some pigs and poultry as early as possible, so as to ensure speedy re-establishment of their holdings and full utilization of any waste material.

Certain administrative actions will facilitate matters. Immediately the Germans are expelled from any region it will be necessary strictly to control the slaughter of animals and to forbid the slaughter of female animals suitable for breeding and milking, and some at least of the working bullocks; if possible, however, bringing in some compensating amount of meat. The distribution of feeding stuffs will need to be regulated, and the veterinary services must be put into operation.

The reduction of livestock has greatly decreased the production of farmyard manure, and this has been intensified by the shortage of fertilizers, especially of phosphates. Immediately the Governments secure possession of their lands, this difficult problem of restoring fertility will need attention. Lupins and seradella can in certain regions be grown as green manure if seed is obtainable. The supply of fertilizers is likely to present many difficult problems because of their localized distribution. Phosphates are obtained mostly from North Africa, and potash from Germany and Alsace; nitrogen-fixing factories are more widespread, but their present products are not very suitable as fertilizers.

Lastly there remains the extremely difficult problem of re-settling on the land the enormous number of people—estimated at some 11–12 millions—taken or deported from the occupied countries. This, however, I do not propose to discuss.

The immediate starting up of agriculture is only a small part of the task. Agriculture is a long-term business; the farmer must know not only what he is to grow this year but also what the year after, and the year after that. So it is necessary to think ahead beyond the 'first-aid period' and to decide what is to be the object of the agriculture. In the first year it must produce calories. But is that to continue permanently? There are two purposes at which European agriculture might aim: highest standard of nutrition for the people; or maximum degree of self-sufficiency for the country or group of countries. Although we did not deliberately aim at it, we in the United Kingdom achieved the highest standard of nutrition in Europe but the lowest degree of self-sufficiency. Germany, on the other hand, achieved a high standard of self-sufficiency but a considerably lower level of nutrition. The British dietary was rich and varied and required large areas of land for its production: on English yields no less than 1·6 acres, of which beef alone accounted for nearly half; but much of our food was imported from countries of lower yield, so that something more than two acres was needed to feed the average Englishman. But the German dietary was much simpler: it contained less meat, less butter and sugar, fewer eggs, less fruit; all these desirable and luscious things were replaced by potatoes, of which the Germans consumed twice as much as we did in Great Britain. Their dietary required less land for its production, and one acre almost sufficed to feed the average German. As they were less densely packed on the land than we are, they were able to produce nearly 85 per cent of their food.

The necessities of war are driving us on to the German dietary: our average consumption of meat—including all sources—is now estimated at about 70 lb. per head per annum—half our pre-war consumption: so that the area of land required for our present dietary is considerably less than it was.

In pre-war times we imported into Great Britain more than 60 per cent of our food, but the import was not evenly distributed. British farmers concentrated on the most lucrative products; they produced the whole of our milk and our potatoes, some 70 per cent or more of our eggs, poultry and malting barley, 50 per cent of all our meat—a much higher proportion of the best-quality meat—but only 25 per cent of our wheat and only 10 per cent of our butter, these being much less lucrative in British conditions. Our pre-war feeding arrangements gave a higher standard of living not only to the people in the towns but also to the farmers and farm workers than the German system. The annual net value of the output of the British farm workers was, before the War, put at £200, while that of the German farm worker was only £70; the average weekly wage for the British worker was 30–36*s.* and was rising, while that of the German was 23*s.* German farm workers had to work at least as hard as ours, but their products were less lucrative and so their remuneration was lower.

The choice before Europe after the War will be self-sufficiency, or high standards of nutrition. In a self-sufficing Europe the inhabitants restrict themselves to what they can produce and go without the rest, or accept instead products for which one must use the German name *Ersatz* because the English language does not possess a sufficiently disagreeable word. Already the Germans have re-organized agriculture in the occupied countries on this basis, aiming at calories rather than protective foods. Grain and potatoes have replaced the more specialized and lucrative live-stock products and fruit of the western countries, Holland, Belgium and Denmark, bringing great distress on their farmers. If this were continued

after the War it would impoverish not only Europe but the primary producers also. Even prior to the War there was considerable over-production of calories in relation to the demand, and this had led to such pitiful results as the burning of wheat in some regions, while others, for example Italy, were suffering from shortages which a policy of self-sufficiency forbade them to satisfy. Representatives of the occupied countries now in Great Britain have expressed their views at conferences of the British Association, Chatham House and elsewhere; they reject the idea of a self-sufficing Europe; they do not want this low standard of life and they recognize that it leads to chaos, even to war. They prefer to aim at the highest possible standard of nutrition: the phrase 'freedom from want' has reverberated through Europe, and aroused among its stricken people hopes and desires that we, who have never suffered as they, can only dimly apprehend. But this policy of abundance means that each region must produce the foods it can grow best, and exchange its products freely with other regions: there is no place for restrictions on trade in food. It is, in fact, the old policy of 'peace and plenty' that Bright and Cobden advocated so long ago.

If this were adopted, the farmers of Europe would aim at producing high-quality protein and protective foods, taking calorie production in their stride but not aiming specifically at it. They would import from the great primary producing regions of the world the additional calories and protein needed for themselves and their animals. After the first year of calorie production their efforts would be diverted to these more profitable activities.

Another decision must also be taken. What is to be the pattern of country life in Europe after the War? Before the War, most of Europe's agricultural land was in small holdings, though there were large estates in Poland, Hungary and elsewhere. Russia, on the other hand, has gone in for large farms. In commerce and industry the large unit has obvious advantages and has in fact eliminated many of the smaller producers. It has been urged that we now have the chance of reorganizing European agriculture and should do it on the basis of large farms, not of small ones. The analogy between agriculture and industry cannot be pushed far because of the fundamental distinction that the processes of industry are wholly under control and can be worked to a programme, while those of agriculture are not: there must on each farm be daily adaptation of programme to weather and other conditions. We have had some very successful large farms, but it has not infrequently happened that when the leading spirit has departed, they break up again into smaller units. Prof. A. W. Ashby recently analysed the returns from a number of farms and showed that the small farms gave a greater return per acre and per £100 expended, employed more men per 100 acres and paid more in wages than the large ones. Actually the case is not as simple as it looks, and the figures need a good deal of qualification: probably the safest generalization is that small farms are best for gross production; large farms for net production.

There would, of course, be a strong case for large farms if Europe were adopting the New Order and going in widely for grain production, this being well adapted to big-scale operations and to heavy mechanization. But the production of protective foods, involving as it does numbers of animals of various kinds, is well suited to the small farm.

A combination of the two systems, large and small, has been worked out in the collective farms of the U.S.S.R. The grain and large cultures are done on the large scale; the farm may be 2,000 or more acres in size and the workers share the produce—or, rather, what is left of it after Government and other dues are paid, the sharing being in accordance with the work done. But in addition, each member of the collective has his own piece of land and his own animals: actually a considerable number of the farm animals of the U.S.S.R. belong to the peasants as their own individual property. The conditions favour the system: the large rolling plains of the south are eminently suited to grain production; the large areas of land not yet utilized prevent any possibility of population pressure on the land, while the high density of population on the farms affords scope for working the individual holdings and tending the privately owned livestock. These conditions, however, do not obtain in any of the European countries.

Representatives of the occupied countries have stated very clearly that they do not want large farms, whether privately owned, State owned, or collective. They admit that some of their large farms have been very productive; some of the Polish estates, for example, have been not only efficient producers but also their homes have been delightful centres of Polish life and culture. But the majority prefer the smaller holdings. So agrarian reform has for some years been busy breaking up these big estates into small peasant holdings. Even where the management has thereby become less efficient, the social advantages are considered to outweigh the economic disadvantages. There is a big peasant population for which provision must be made. Industry is not far enough advanced to absorb large numbers, and emigration is probably out of the question. Also, there is very real land hunger; the innate desire to own a piece of land—usually a particular piece of land. In eastern Europe this has even become a line of political cleavage, and strong Peasant Parties exist in Poland, Czechoslovakia, Jugoslavia and elsewhere.

The history of collectivization in the U.S.S.R. is a clear warning against forcing on the peasants any scheme of amalgamation that they do not like. For the first few years of collectivization the numbers of animals fell drastically: there were several causes, but one was the dislike of some of the peasants for the new scheme. Then came the compromise in 1935 and 1936, which allowed the peasants their own bit of land and their own animals, and the numbers of animals began to go up: unfortunately the War came before one could see the full results. We could not, however, tolerate the possibility of peasant disturbances in Europe after this War, and so we must accept the decision to re-establish small peasant farms.

But they need not reproduce the technical and economic weaknesses of the old ones. All the countries concerned have set up agricultural research, advisory and educational services, and the small farmer can be given all the advantages of better varieties of crops, more efficient fertilizers, more economical rations for his livestock, better health services for animals and for crops. Further, agricultural engineers are now turning their attention to the design and manufacture of small implements suitable for small farms that will not only lighten the work but also enable it to be done much more quickly, so avoiding many of the wastes and losses

resulting from slower methods. Electricity and the internal combustion engine have the great advantage that they are little less economical for a small job than for a large one. The small farmer need be neither inefficient nor a drudge; he can be technically competent and provided with labour-saving implements.

In the past, the financing of the farm and the buying and selling of the produce have been major difficulties in the life of the peasant. The moneylender and the middleman—whether they were one and the same or different individuals—have often made the peasants' life a burden. Marketing of produce has always been a wasteful procedure; the bulky material has been sold to a middleman and the small stuff taken by the women to market and there sold for whatever it would fetch—a time-consuming operation which, however, was very sociable and clearly enjoyed by the women. These and many other difficulties can be got over by co-operation, and I am firmly of opinion that the only hope of successful establishment of peasant holdings lies in the development of a strong co-operative movement. The Horace Plunkett Foundation in Great Britain is a mine of information on the subject; Denmark can show actual working models, and indeed most of the occupied countries have some experience with it. Co-operative societies can not only buy for the peasant, finance useful operations and warn severely against useless ones; they can also take over the peasants' products, grade and process them, pack them properly and sell them through expert salesmen who know the best markets and can obtain the highest prices. They can thus assure to the peasant the maximum return for his labour.

The experience of Denmark shows how well co-operation can flourish in an educated community. Education is absolutely essential; not simply technical education, but, what is even more important, the moral education that teaches a man to pull his weight and play the game; to accept his full share of responsibility for the community, doing the right thing because it is right and not simply because he fears he might otherwise be caught. In addition to agricultural schools, the Danes early set up 'Folk High Schools' to give this moral training to awaken intelligence and idealism; they were Christian, national institutions and they helped to form an industrious, honest, competent farming community composed of extremely hard-working people, producing commodities of high quality and enjoying a standard of life that was the envy of most of Europe. The Danish small farm expresses the ideal at which many of the leaders of the occupied countries are looking with longing eyes, hoping that when their long night of agony is ended there may dawn a brighter day for themselves and their children.

We, too, shall have our part to play. In his extremely interesting "Life" of Marlborough, Mr. Churchill shows how in the seventeenth and eighteenth centuries Great Britain twice saved Europe by heading the Allied Nations against a power seeking to dominate the whole Continent. Twice the war was won, but twice the peace was lost because we withdrew too soon. Modern history has made the lesson more emphatic; nations cannot live in isolation. On all grounds—economic, political and moral—we must in the reconstruction of Europe render all possible help and continue to play our part in the years of peace to which the nations are looking forward with such ardent longing.

EDUCATION IN THE BRITISH ARMY

By LIEUT. T. H. HAWKINS

TWO and a half years ago the British Army education scheme as we know it to-day was officially launched as the "greatest experiment in adult education that has been undertaken in this country". During its period of growth the scheme has come in for a great deal of publicity, adverse and otherwise. A review of its progress may be of use in helping to assess its value as an indication of the way in which adult education is likely to develop in Great Britain in future years.

In the months preceding the outbreak of war the Workers Educational Association and the Y.M.C.A., in consultation with the Board of Education, had convinced the War Office that educational opportunities of a general character, apart from any classes and lectures which form part of military training, should be provided for the young militiamen during their six months compulsory training. To meet the potential demands for lecturers, the universities enlarged their extra-mural boards *ad hoc* by adding to the representation of the voluntary bodies concerned and began to lay plans for their active participation in the scheme. War came, and these *ad hoc* committees were dispersed.

But the demand for education could not be ignored. In the early part of 1940, the initiative of the various voluntary organizations connected with adult education led to a widely representative conference at which the setting up of a Central Advisory Council for Adult Education in H.M. Forces was decided upon. In due course the universities, local education authorities and voluntary organizations for adult education appointed members, the three Services nominating observer representatives. The vice-chancellors of universities and principals of university colleges were invited to call conferences in their areas, for the purpose of establishing regional committees through which the Central Advisory Council might work. Thus the civilian educational resources were mobilized and placed at the disposal of the Services.

Later a committee met under Sir Robert Haining to consider means whereby the Army's own resources for lecturing and teaching, as well as organization and administration, might be established. (Here it may be noted that, at the outbreak of war, the personnel of the Army Educational Corps of the Regular Army were transferred to operational roles, for the discharge of which in France they were officially commended by Lord Gort in his dispatches.) The report of the Haining Committee appeared in August 1940, and it is from that date that the scheme as it now exists may be said to have had its birth.

A directorate of Army education was established, the first director being Mr. F. W. D. Bendall, who was seconded from the Board of Education. The Army Education Corps was gradually strengthened, both by the return of its regular peace-time personnel and by the inclusion of new members from the war-time Army.

The objects of the scheme can be briefly stated: (1) maintaining the men and women of the Army in good heart and morale by the provision of educational activities which could be pursued in their off-duty hours; (2) improving the military efficiency of the fighting services directly by the sharpening of mental

faculties through constant stimulation and indirectly by the elimination of boredom; (3) the provision of incentives and opportunities so that men and women should be given every chance of pursuing their peace-time occupations in preparation for their return to civilian life.

Those who had been appointed to implement this scheme were now charged with making themselves worthy of it. The first task lay in promoting publicity, and, from the beginning, the co-operation of the troops was invited by asking them to submit posters to illustrate the facilities offered by the Army education authorities.

By February 1941 the provision of educational facilities for men and women in the Forces was going steadily ahead, although many soldiers in communications to the Press still complained that in their units educational activities were non-existent. But in spite of lectures postponed and courses interrupted by operational duties, even at that time an average of some four thousand lectures and three thousand classes were taking place each month. Most of the lectures and classes were taken by civilians, but in many cases Service men and women with specialist qualifications gave their support.

It must be realized that the successful operation of an educational programme under war conditions was not an easy task. Apart from the difficulties of administration, organization and accommodation, many lecturers found to their great surprise that lecturing to troop audiences was not quite the same as to, say, a W.E.A. audience. Men and women in the Forces form a representative sample of the entire population, and their attitudes to education were as varied as one would expect from such a heterogeneous group. For many soldiers 'education' was but a means of sending them to school again with the implication that they were 'dunces'. Some wore the smile of incredulity; others were afraid of being made to look small and had the marked fear and distrust of budding educationists, which is such a characteristic 'hang-over' of their school-days for so many. Further, a fair proportion of the soldiers are quite inarticulate, while others regard any attempts at discussion as personal disparagements of their characters. (May not one concrete aim of education in the future be to train men in argument so that, although differing violently from their fellows, they part on friendly terms? This is probably even more necessary for women than men.)

Despite all the difficulties, however, the war-time scheme gained momentum. In order to make the fullest use of unit resources and to train regimental instructors, short courses primarily designed to give basic training in citizenship, knowledge in international affairs and in the methods of instruction, and the running of discussion groups were instituted. For units stationed in towns and villages, the accommodation problems were eased by civilian co-operation, arrangements being made whereby small classes were able to meet in private houses on certain evenings. In some cases buildings were requisitioned and converted into Army study clubs and were used for diverse activities. Most of the educational activities, however, were still being carried out in the uncongenial surroundings of barrack-rooms. To meet this situation the Army Council authorized the provision of quiet rooms for educational studies, and to-day the appearance of, and educational activity in, a unit 'quiet room' is often a guide to the military efficiency of the unit.

With the development of 'academic' pursuits other activities began to emerge. Soon, all the practical classes which one associates with a modern technical college were in operation in some unit or other. These were either conducted in adjacent technical institutes or, in some cases, at neighbouring works when the employees were off duty. (One engineering firm held very successful classes in motor engineering for troops on Sundays.) Practical classes have grown apace and now the 'hobbies and handicrafts room' is one of the show-places in many units.

Music for the Forces has been greeted with enthusiasm similar to that which has revealed itself all over Great Britain during the last four years. Each Command has a full-time E.N.S.A. music adviser; the growth of music clubs in units has been such that these advisers must be rated as among the most hard-worked people in the Army.

So the story unfolds. Interest in the fine arts has been nourished and is bearing sound fruit. Fullest possible use has been made of visual education, and touring pictorial exhibitions have become a common feature of the educational scheme.

Nor have the Army authorities been negligent in developing new methods in education: in many units where facilities for seeing newspapers and hearing broadcast news are poor, 'wall newspapers' have been produced and have become a most effective method of stimulating and maintaining interest in current events as well as providing information about local affairs. From these 'wall newspapers' to the provision of separate information rooms was not a far flight, and these have now become well-established features of Army education.

To meet the demands of troops in units that are constantly on the move, correspondence courses were introduced. These consist of vocational courses, covering nearly all the examinations for the recognized professions, and postal study courses, including those subjects which might conveniently be described as catering for the academic examinations, including pre-matriculation. The initial problems that were raised by the inauguration of such a tremendous scheme have now been ironed out, and many of the more serious students admit their indebtedness to the correspondence scheme. Between September 1941 and March 1943 there were 22,000 enrolments for vocational correspondence courses and 14,300 for postal study courses. In passing, it should be mentioned that this is the only educational activity for which a small fee is charged, the sum of 10s. being charged in order to exclude those who were likely to fall at the sight of the first hurdle.

The work of the Army Education Corps in hospitals deserves special notice. One soldier in hospital means that the fighting efficiency of his unit and of his country has been reduced. In co-operation with the Royal Army Medical Corps, the Army Education Corps has promoted educational activities in military hospitals designed to return the man as quickly as possible to his military duties. Occupational therapy remained the charge of the medical authorities, while the educational instructors were given the task of promoting educational pursuits of a miscellaneous nature which would provide the patient with diversional occupations and speed his recovery and return to duty. These miscellaneous activities are too numerous to mention, but it can be confidently asserted that Army education has made an important contribution to adult education in its hospital scheme. When the full story is told, it is incumbent

on all adult educationists to make themselves fully conversant with it.

From the foregoing it can be seen that the programme for education in the war-time Army is very comprehensive and has been tackled with ardour and enthusiasm despite desperately discouraging circumstances. Yet until September 1941 the men charged with operating this programme were keenly aware that they were achieving only a small part of their objective. The voluntary nature of the scheme meant that the educational facilities available were being used only by those people who would normally be engaged in some form of educational pursuit in their peace-time occupations, estimated at about 20 per cent of the whole. The other 80 per cent remained the hard core who displayed little interest and yet included most of the men for whom some form of education was greatly to be desired and who stood in greatest need.

To meet this need a measure of compulsion was necessary. This was first provided in September 1941, when the Army Bureau of Current Affairs was introduced. An official order was issued asking commanding officers to make arrangements for all the personnel on their establishments to be given instruction in current events for one hour each week *during training hours*. This hour was introduced in order that soldiers might keep abreast of current affairs and so know the purpose behind their duty. In order to surmount the difficulty of shortage of specialist instructors, it was decided that the scheme should be administered by regimental officers. Each officer was charged with carrying out the Army Bureau of Current Affairs hour in his particular platoon or section. As an aid the Army Bureau of Current Affairs issues him with a brief each week on which to base his talk. These briefs are of two kinds and appear alternately. One, called "Current Affairs", aims at providing a background of knowledge against which current events can be assessed and understood. The other, "War", aims at providing a picture for the soldier of what is happening in the various theatres of war. The most important issue raised by the introduction of the Army Bureau of Current Affairs, however, was the expressed statement that each talk should form the basis of discussion and that all soldiers should be given opportunities to air their opinions freely, however far-fetched and unsubstantiated they might be. There is little need to dwell on the success of this scheme. It is enough to say that the Army Bureau of Current Affairs to-day is recognized as an integral part of Army life. Its establishment has undoubtedly assisted in promoting better relations between all ranks as well as in the maintenance of morale by disseminating facts about the high purpose of our cause.

It must be made clear that the introduction of the Army Bureau of Current Affairs did not mean the discontinuance of other educational activities. Far from it. These continued to flourish and were considerably extended by the compulsory nature of the Bureau. By last autumn Army education had made such progress that the Army Council agreed to introduce compulsion for other educational work. Accordingly a scheme was drawn up designed to be carried out during the period November 1942–February 1943. At least three hours per week were to be allotted from training or working hours to education. It was suggested that three hours should be used in the following manner:

(*a*) One period to be devoted to educating the man as a soldier, for example, by providing instruction in map-reading, message writing, etc.

(*b*) One period to the education of the man as an individual. In this period men were to be encouraged to pursue subjects of their own choosing.

(*c*) The other period to be concerned with the education of the man as a citizen. This period is devoted to talks and discussions on the British mode of life, its institutions and methods of government, the British Commonwealth of Nations and British relations with the other members of the United Nations. To cover the citizenship period, monthly directives were issued and met with a very favourable reception.

This scheme has now come to an end and, where commanding officers have lent their support, has achieved considerable success. The citizenship period, in particular, has contributed so much to Army life that the War Office has decided that it shall continue, based on other topics, over the next few months at least.

"The greatest experiment in adult education" is a fitting description of such a gigantic scheme. But even this is only a prelude to the tremendous educational operations which must inevitably be introduced when victory comes and we are faced with the problems of demobilization. We can never be over-prepared. The place of science in this scheme was outlined in the columns of NATURE of August 16, 1942, p. 173, and a letter from Dr. Basil Yeaxlee in NATURE of September 6, 1942, p. 288. It is hoped to discuss it more fully at a later date.

INDIGENOUS MALARIA IN GREAT BRITAIN

By SIR ARTHUR MACNALTY, K.C.B.

DR. WILLARD C. RAPPLEYE, of Columbia University, has recently issued a warning that after the War the United States will probably be faced with the risk of epidemics of malaria, brought about by the return of malarial patients who have served in the Middle East and other theatres of war where the disease prevails.

In the United States, malaria has progressively diminished in extent and severity during the past eighty years. From New England, where it once prevailed extensively, it has gradually disappeared, and in Philadelphia and along the valleys of the Delaware and Schuylkill Rivers, formerly hot-beds of malaria, the disease has become much more restricted. In Baltimore a few cases occur in the autumn, but the majority of the patients come from outlying districts and one or two of the inlets of Chesapeake Bay. Throughout the Southern States there are many regions in which malaria prevails; but here, too, the disease has diminished in prevalence and intensity. In temperate regions, like the central Atlantic States, there are only a few cases in the spring and a large number of cases in the autumn. In the Northwestern States malaria is almost unknown. It is rare on the Pacific coast, and in the region of the Great Lakes it prevails only in the Lake Erie and Lake St. Clair regions.

The introduction of fresh foci of infection from abroad would obviously be inimical to this favourable picture, and a similar danger to that foreshadowed by Dr. Rappleye faced Great Britain in the War of

1914–18. The total number of locally contracted cases notified or discovered by special inquiry after September 1917 amounted to 330, of which 38 were in the Navy, 224 in the Army and 68 in the civil population. It appears that 231 of these cases were contracted in 1917 and 99 in 1918. One interesting observation was the detection in 1918 of some patients in whom an infection contracted in the previous autumn had remained 'latent' during the winter. This was previously noted in England during the early years of last century[1].

The sources of infection were multiple. In the Army, the origin of practically all the locally contracted cases was attributable to the presence in their immediate neighbourhood of relapsing cases of malaria among soldiers returned from eastern war areas, especially Salonika. The same source was usually responsible for cases among naval ratings and civilians.

At certain English ports during 1917 and 1918, a potential source of infection of considerable importance was provided by the crews and passengers of transports and merchant ships which had called at Dakar, Sierra Leone and other ports on the west coast of Africa. During the War, malaria was exceptionally prevalent and severe in these ports. In 1917 more than five hundred cases of malignant tertian malaria were introduced into England on ships from the West Coast and the Cameroons. Fortunately, the Anopheles of Great Britain do not act as efficient carriers of tropical malignant malaria[2]. In addition, it was found in some cases that malaria seemed attributable to infection, not from military foci, but from civilian patients in their immediate neighbourhood and, in a few instances, to civilian cases which had occurred before troops began to return from Salonika. Such an indigenous origin was ascribed to a considerable local spread of malaria in Kent. It was stated, for example, that so late as 1865–70 "nearly everyone in Queenborough suffered from ague" and that occasional cases had occurred every year since that time. The clinical symptoms of these Kentish cases were less severe than those of cases which were traced to an origin from military foci.

Malaria was formerly prevalent in Great Britain. In Sydenham's time agues were both frequent and fatal. James I and Oliver Cromwell both died of ague contracted in London. In the eighteenth century malaria was endemic; almost exclusively, along the eastern coast; in parts of Kent, Essex, Cambridgeshire, Norfolk, Suffolk and the East Riding of Yorkshire. Malaria prevailed then also in the eastern part of Scotland, especially in East Lothian, where the reapers at harvest-time were always attacked by it. In the nineteenth century the disease diminished greatly in Great Britain owing to the drainage of the fens and marshlands, which were brought under cultivation.

The presence of these endemic foci of malaria is not generally recognized by the medical profession and the public. They do, however, exist, and investigation by medical officers of the Ministry of Health in the intervening period between the last and the present War indicates that the distribution of indigenous malaria in England is about the same as that already described for the eighteenth century. Sinton and Shute advance sufficient reasons for believing that the density of *Anopheles maculipennis* offers the most likely explanation of this topographical distribution[3].

Indigenous malaria, which usually takes the benign tertian form, is not common; the symptoms are usually mild, and instances of this type escape recognition unless malaria forms the subject of intensive investigation as in war-time. In peace-time there are always a certain number of imported cases in persons who have originally acquired malaria abroad; there were 354 such cases with 30 deaths in 1938, as contrasted with two indigenous cases in the same year. Such cases help, no doubt, to keep the strain of the benign tertian parasite persistent in England.

Although there are four species of Anophelines in Great Britain, only one species, *Anopheles maculipennis*, has so far been proved to be a carrier of malaria: this species is made up of a number of varieties or sub-species, which, while as yet indistinguishable in the adult stage, can be differentiated on the character of their eggs. Two varieties occur in England—one (var. *messeæ*) breeds in the fresh water of inland ponds and streams, the other (var. *atroparvus*) mainly in brackish water in coastal areas, but may occur in smaller numbers in inland waters. The latter variety is the chief carrier of malaria in Great Britain.

In peace-time the problem of the transmission of malaria by mosquitoes is seldom one of magnitude in Great Britain, and most measures against mosquitoes are usually undertaken in order to reduce their biting propensities. In war-time the problem naturally assumes a more serious aspect.

The successful policy pursued towards the end of the War of 1914–18 was based primarily on the early detection of all cases and carriers, followed by thorough treatment, protection from mosquitoes, and special supervision and control. On the military side this policy was adopted throughout Great Britain, and it was supplemented in a few areas by local anti-mosquito measures directed against breeding-places. In view of these arrangements by the Army authorities, on the civil side exceptional precautionary measures, including notification, were at first limited to a few localities, which were selected either because cases of indigenous malaria had already occurred in them, or because they were places in which a considerable concentration of possible human malaria carriers coincided with an abundance of Anophelines. This limitation was justified in 1918, for only three cases of indigenous origin occurred outside the selected localities.

After the armistice of 1918, with demobilization, the possibility of local spread of malaria had to be watched. Accordingly the Local Government Board in January 1919 in a General Order (Public Health (Pneumonia, Malaria, Dysentery, etc.) Regulations, 1919) (afterwards amended by the Public Health (Infectious Diseases) Regulations, 1927) included clauses which imposed on local authorities and their officers throughout the country certain new powers and duties in regard to malaria prevention. Malaria cases, including those of demobilized ex-Service men, and others who have contracted infection abroad, are made notifiable in England and Wales. The medical officer of health in any district is empowered to investigate risks of local spread of malaria and to take any necessary action to prevent it. For example, when a man suffering from malaria occupies a house which is infested by Anophelines, at the cost of the local authority mosquito netting can be provided, suitable quinine treatment given, and proper advice afforded as to the precautions needed against the spread of infection. The medical officer of health, after confirming the diagnosis and the local origin of

the case, should send the name and address to the Ministry of Health with all available particulars. All practical assistance is given by expert officers of the department to medical officers of health and medical practitioners in any case in which indigenous malaria is suspected. Blood films and other specialized examinations are arranged for.

The malarial work of the Ministry of Health was afterwards augmented by the provision of a malarial laboratory and centre at Horton Mental Hospital, Epsom, on the suggestion of Lieut.-Colonel S. P. James. The primary object of this unit was to provide treatment for general paralysis of the insane by induced malaria as initiated by Wagner-Jauregg of Vienna. The Board of Control, the London County Council and the authorities of Horton Hospital are closely associated with the Ministry in this work. The laboratory portion of the unit was under the control of Colonel James and afterwards under that of Lieut.-Colonel J. A. Sinton, assisted by Mr. P. G. Shute and laboratory assistants, while Dr. W. D. Nicol, medical superintendent of Horton Hospital, is in charge of the clinical side of the work. The unit further acts as a centre for the study and identification of mosquito nuisances in Great Britain, and a number of important papers and reports on the subject have been published by James, Nicol and Shute. Mr. Shute has paid visits to many districts in Great Britain and has advised on the control of Anophelines.

With all this administrative and scientific machinery to hand, it can be confidently anticipated that the Ministry of Health will safeguard the population of Great Britain against the risks of an increase of indigenous malaria after the present War as successfully as it did after the War of 1914–18.

[1] Reports and Papers on Malaria contracted in England in 1918. Reps. to L.G.B. (N.S. No. 123.) (London: H.M. Stationery Office, 1919.) See also P. G. Shute: "Protracted Incubation Periods in Indigenous Cases of Malaria in England", *J. Trop. Med. and Hyg.* (July 15, 1939).

[2] Shute, P. G., "Failure to Infect English Specimens of *Anopheles maculipennis* var. *atroparvus* with Certain Strains of *Plasmodium falciparum* of Tropical Origin", *J. Trop. Med. and Hyg.* (July 1, 1940).

[3] Sinton, J. A., and Shute, P. G., "Memorandum on Measures for the Control of Mosquito Nuisances in Great Britain". Memo. 238/Med. Ministry of Health. Revised Edn. (London: H.M. Stationery Office, 1943.)

OBITUARIES

Major Leonard Darwin

WITH the death of Leonard Darwin on March 26, in the ninety-fourth year of his age, has passed the last of the five sons born to Charles Darwin. Taking the five sons in the order of their birth, William, the eldest, showed no aptitude for science; the second, George, the third, Francis, and the fifth, Horace, were gifted with creative faculties of a high order, all three becoming fellows of the Royal Society. Leonard, who came fourth in the series (he was born at Down House on January 15, 1850), although he did much to further the cause of science, manifested none of those creative gifts which had been so liberally bestowed on his father and three brothers. Yet, in physical appearance, especially in later years when he grew a beard, in his attitude to life, and in the disposition of his mind, he bore a closer resemblance to his father than did any of his brothers. He had his father's honesty of expression, openness of mind, charitable disposition, subjugation of self, an excess of candour ("d——d candour" his father named it on a certain occasion when irritated by unfair criticism) and also his father's happy sense of humour. He was completely devoid of personal ambition. There were not a few, however, who were ambitious on his behalf and felt that his services to science should have been recognized by election to the Royal Society. The University of Cambridge rightly bestowed on him an honorary doctorate of science.

In 1868, at the age of eighteen, Leonard entered Woolwich, being second on the list at the entrance examination, a success which made his father exclaim: "I shall burst with pleasure at Leonard's success!" He served with the Royal Engineers for twenty years, retiring in 1890 on attaining his majority. During this time he was a member of two expeditions sent to observe the transit of Venus—in New Zealand (1874) and in Queensland (1882)—but for the greater part of his service he was engaged in the routine of office work or of acting as instructor at various staff colleges.

On retiring from the Army, Leonard Darwin entered public life, being elected Liberal Unionist member for the Lichfield Division of Staffordshire in the Anti-Home Rule election of 1892. In the election which followed three years later, he lost his seat and eventually retired from politics. Perhaps no one was less fitted for the rough and tumble of political life than Leonard Darwin. He was completely devoid of the "Party spirit". He looked on politics as the art of applying science to the problems of government. We see the trend of his mind at this time, in two publications which he issued at the close of his brief political career—on "Bimetallism" (1898), and on "Municipal Trading" (1903). He served (1913–20) as chairman of Bedford College for Women.

His real work in life came to him in 1911 on the death of his distinguished cousin, Sir Francis Galton. Galton had founded the Eugenics Society in 1908 (by the way, it is just sixty years since Galton coined the term 'eugenics'), and served as its honorary president until his death in 1911. Thereupon Leonard Darwin fathered the Eugenics Society, and continued to devote all his energies to promoting its welfare until 1929, when the late Sir Bernard Mallet took over the presidency, while Darwin continued to serve the Society as its honorary president. His attitude towards eugenics is given in detail in a book published in 1926, entitled "Need for Eugenic Reform".

In 1928 he withdrew from London, making his home at Cripps Corner, on the western outskirts of Ashdown Forest. He was twice married, first to Elizabeth Fraser, who died in 1898, and later to his cousin, Charlotte Mildred Langton, who died at Cripps Corner in 1940. There were no children by either marriage. Those who had the privilege of visiting at Cripps Corner carried away unforgettable memories of human life at its best.

ARTHUR KEITH.

Mr. H. D. Taylor

HAROLD DENNIS TAYLOR, a quiet man of simple tastes, varied interests, and wide knowledge, died on February 26, aged eighty-one. Probably best known as the inventor of the Cooke lens, he achieved much else that would have brought him fame.

Taylor was educated at St. Peter's School, York, and began to train as an architect, but was offered employment at the works of Thomas Cooke and Sons, scientific and surveying instrument makers, on

account of his scientific interests. His inventive ability soon showed itself, for within a short time of entering his new occupation he took out the first of a long series of patents. In a few years he had become optical manager and soon afterwards a director of the Company.

Fine optical instruments may be the outcome of artistic or of scientific work. The great men of the past—Thomas Cooke himself, for one—took pride in their rightful description as artists. To-day we live in a scientific period. Dennis Taylor belonged to both—he combined in the happiest way both the artistic and the scientific ways of working. When his professional career began there were no books which could be used as guides by the young optician, and Taylor set out to build up a body of theoretical knowledge. He took as his model Airy's work and its development by Coddington. The task extended over many years, but valuable results were reached by the way. For example, by close study of his formulæ, Taylor decided that better photographic lenses could be made by using three separated achromatic doublets. His method apparently consisted in making up an instrument to a specification based on an approximate theory, and observing the character and magnitude of the outstanding defects. Modifications for removing these defects were made on the same theoretical basis, and this process was continued until he was satisfied with the result. To this extent the theory of the original form of Cooke lens preceded practice. The later form composed of three single lenses was evolved by a process in which practice came before theory. Of the Cooke lens itself it is sufficient to say that it is the foundation of many most successful later types, including some of the most recent. Of all existing designs it is probably the one which an artistically minded designer would most like to have produced.

In his theoretical work, having derived complete formulæ of the first two approximations, Taylor set out to construct a complete system of the third and if possible of the fourth orders. In this he was only partially successful, for the methods he employed were probably inadequate for so difficult a task. The results of his work were published in 1906 under the title "A System of Applied Optics". There can be little doubt that it was the most important book on this subject that had appeared in English for nearly a hundred years, and Taylor showed remarkable magnanimity, which unfortunately has rarely been imitated, in making his work available to other lens designers.

It is only possible to mention one or two of Taylor's many other activities. In 1892 he produced his 'photo-visual' objective, which marked a great advance in telescope construction, and was largely used for mapping the heavens. A valuable little book, "The Adjustment and Testing of Telescopic Objectives", appeared in 1901, and in 1904 he discovered a process for increasing the light transmission of lenses—the forerunner of the modern 'blooming' process.

His work was most appropriately recognized by the award of the Duddell Medal of the Physical Society and of the Progress Medal of the Royal Photographic Society.

Following his retirement from active business, Dennis Taylor went to live in the beautiful village of Coxwold, beloved by him and his ancestors. He leaves a widow, two sons and a daughter. His younger son is the optical manager of Cooke, Troughton and Simms, Ltd., the successor of T. Cooke and Sons.

T. SMITH.

NEWS and VIEWS

Association for Scientific Photography

PHOTOGRAPHY has firmly established itself as an essential scientific instrument, and a wider knowledge of the uses to which it can be put would do much to assist in the solution of the problems confronting workers in science and industry. Many workers either have difficulty in obtaining information concerning photographic techniques, or are unaware of their existence. For these reasons, a group representing widely different fields of science and industry believe that a new organization designed to meet their special photographic requirements would be of considerable value. The Association for Scientific Photography has therefore been formed, the objects of which can be briefly stated as follows:

(1) To promote the advancement of photography in all branches of science, technology and medicine, and to assist its members in the application of photographic methods to the solution of particular problems.

(2) To afford its members opportunities for interchanging opinions and discussing matters connected with photographic techniques. Meetings will be arranged from time to time at which papers and short communications will be delivered and discussed, together with practical demonstrations of apparatus and methods. It is the intention of the Association to publish the proceedings in a journal as soon as conditions permit.

(3) To establish an information bureau containing, so far as is possible, full particulars of the activities of members, and in suitable cases the existence and whereabouts of specialized photographic apparatus. These data will be used by the Association for the benefit of its members as a pool from which information may be drawn on the varied applications of photography to research, industry and teaching.

(4) To endeavour to obtain for members information on practically any photographic problem which may arise in the prosecution of scientific work.

(5) To foster the production of sub-standard films for research and teaching purposes, and to give information on methods of production and presentation of films of scientific interest.

The field covered by the Association must, of necessity, be a wide one in order to carry out its functions. It will embrace photographic processes of all kinds, such as radiography, colour photography, photomicrography, high-speed photography and, in particular, sub-standard kinematography in all its branches. Membership of the Association is open to any person actively engaged or interested in the use of kinematography or photography as a scientific instrument. An announcement of the first meeting will appear in due course. The committee of the Association consists of the following: Prof. J. Yule Bogue (chairman), professor of physiology, Royal

Veterinary College; S. Boyle, Photographic Section, I.C.I. Research Dept.; Miss K. C. Clark, radiologist, Ilford, Ltd.; G. A. Jones, Research Dept., Kodak, Ltd.; E. H. Le Mon, Tanar (British) Corporation; Dr. H. Mandiwall, dental surgeon; C. D. Reyersbach, of W. Watson and Son, Ltd.; G. H. Sewell (treasurer), Ministry of Supply; R. McV. Weston (organizing secretary), Ministry of Supply. Further information can be obtained from the organizing secretary, R. McV. Weston, whose present address is Houndwood, Farley, Salisbury, Wilts.

Committee on Nutrition Surveys

INVESTIGATION on certain aspects of nutrition is at present handicapped by lack of co-operation. In view of the importance, at the present time, of a thorough knowledge of the state of nutrition in Great Britain, the Nutrition Society has accordingly set up a Committee on Nutrition Surveys, with Sir Joseph Barcroft as chairman; the terms of reference are the co-ordination of nutrition surveys dependent on (*a*) clinical, physiological and biochemical examinations of human subjects, (*b*) examinations of food budgets, and (*c*) chemical analyses of food and meals (including collective meals). It will put investigators in touch with others who are working on the same lines or would co-operate; it will supply information, recommend methods and make periodical summaries of the results of investigations. The Committee has the support of the Ministries of Health and of Food and co-operation of the Services. Prof. J. R. Marrack has been appointed as a director serving under the Committee. All who are engaged on or undertaking investigations covered by the terms of reference are invited to communicate with Prof. Marrack at the London Hospital, Whitechapel, E.1.

Soviet Medical and Scientific Men

N. EGOROV writes: The Medical Section of the Allunion Society for Cultural Relations with Foreign Countries is strengthening the scientific bonds of Soviet medical circles with medical institutions, organizations and scientific workers in other countries. At the last plenary meeting of this Section it was announced that the Section has received many requests from medical institutes, societies and individual scientific men wishing to establish or revive connexions broken off by the War. The Section has taken steps to make this possible. It has done much to forward abroad books and articles written by members of medical institutes in the U.S.S.R. and to send greetings from Soviet scientific men to various journals and to workers in the field of medicine. The Section has also dealt with numerous requests from Russian men of science for books and articles not available in Moscow to be sent from Great Britain and the United States. To make widely known the work of Soviet medical institutes, clinics and scientific workers, the Section regularly publishes the *Medical Chronicle*, which reflects current war-time problems of Soviet medicine. It has also selected for foreign countries scientific films on various medical subjects such as "Physiology and Morphology of Bacteria", "Microscopic Study of Living Tissue" and "Physiology and Pathology of the Heart", in the production of which eminent Soviet men of science took part. Nicholas Semashko stated that the Section receives publications issued by the Medical Society of America and a War-time Medical Review from Great Britain published by the Anglo-Soviet Committee of Medicine. All this literature is handed over to the Central Medical Library and to libraries of various medical institutes, so that wide use can be made of it. Addresses of members of the Section on the report of Prof. Nicholas Semashko discussed the strengthening of scientific ties with medical organizations and individuals abroad. The Section aims at facilitating the exchange of experience in the medical sciences and increased collaboration of Soviet, British and American medical workers. Nicholas Burdenko, of the Academy of Sciences of the U.S.S.R., was presented at the meeting with a complete set of surgical instruments sent to him from Philadelphia.

Science and Reconstruction in Canada

IN a paper, "Science and Reconstruction in Canada", read at a joint session of the Royal Society of Canada at the University of Toronto on May 29, 1942, which has now been reprinted, Prof. J. K. Robertson points out that in the industrial and social fields, the federal and provincial governments in Canada have already shown that they are aware of some of the urgent problems which will have to be met when victory comes. Referring to specific ways in which the services of the scientific worker are essential, Prof. Robertson instanced the increased use of Canada's coal deposits, particularly methods of utilizing coal at its source; and the depletion of existing ore reserves and the desirability of discovering new sources of both old and new materials and developing new processes of extraction, for example, for magnesium. After speaking of the utilization of waste materials, such as natural gas, as a field for research, he referred to schemes intended to promote decentralization or dispersal of industry, the industrial utilization of farm products, and a general improvement in living conditions and in methods of farm operation through more available and cheaper power. Although in part economic questions, the practicability of such schemes depends largely on the work of the man of science. Again, in regard to the farm as a source of raw materials, the position of the plastics industry requires consideration in relation to agriculture. The soya bean, for example, is the raw material, not only for oil but also for a new cloth and for a plastic adhesive for plywood, while such materials as straw and cereal refuse might conceivably also find uses in the plastics industry.

Finally, Prof. Robertson considered the relation of science to society, and suggested that science should be more than the handmaid of the State. Science should recognize that it has a social mission and accept a wider responsibility than in the past. Problems involving co-ordination of the sciences, a wiser application of new discoveries, and quicker and better State action following official reports would be helped greatly by the establishment of a small scientific advisory council to act in a liaison capacity between science and government. It would also be of great value in the consideration of the larger social issues which will have to be faced in the post-war years. Scientific men, collectively and individually, must also do more to educate the general public about the nature of their investigations. They gladly recognize that man does not live by bread alone, but they claim that a type of training which insists on honest inquiry, impartial judgment and a fearless facing of all facts is not altogether remote from the other tradition which puts the emphasis on truth, beauty and goodness.

Peoples of the Philippines

THE war in the Philippines has not been forgotten, nor has the courageous part played by the Filipinos alongside their American allies. But the average individual knows little about the geography of the Philippines, and less about the folk who inhabit them. To remedy this state of affairs, the Smithsonian Institution has produced War Background Studies No. 4, "Peoples of the Philippines", by Herbert W. Krieger; it contains 86 pages of interesting print, a number of well-chosen illustrations, and an extensive bibliography. An account of the topography, climate, and kindred subjects is given, but most of the work is devoted to a description of the people. As might be expected, they are for the most part very mixed in origin and are the result of more than one culture contact in the past. This is clearly apparent in the realm of religion, where it appears that many pagan Indonesian ideas and superstitions still persist, although the large majority of the inhabitants are Christians. The material culture of some of the more primitive tribes includes knives of various kinds, bows and arrows, and the blow gun. The darts in use with the latter are often poisoned, there resulting an exceedingly effective weapon for killing small game silently. Various types of houses are illustrated, and a description of the language given. But anyone wanting to know more about these islands and their interesting inhabitants, who surely will have a not unimportant part to play in the post-war world in the Pacific, should read for himself about the islands and their inhabitants.

New Farm Crops for Australia

AUSTRALIA possesses three main stations for testing the agricultural and horticultural suitability of various kinds of plants from other regions for Australian conditions. Pamphlet No. 114 of the Commonwealth of Australia Council for Scientific and Industrial Research (314 Albert Street, East Melbourne, Victoria), by A. McTaggart and T. B. Paltridge, gives details of some of the useful and outstanding species tested at the Lawes (Queensland) station, which has a sub-tropical climate. Among the outstanding introductions is *Stylosanthes guianensis*, which appears to be capable of assuming the agricultural role of lucerne (*Medicago sativa*) under tropical conditions. The variety *polia* of *M. sativa* is also suitable. Two kinds of cocksfoot grass, *Dactylis glomerata* var. *hispanica*, from southern France, and a strain from Algeria, also appear among the outstanding introductions. Details of the yield of *Paspalum scrobiculatum*, *Urochloa pullulans*, *Panicum maximum* and Rhodes grass are given, and indicate higher potential yields than are obtained from present grassland. *Phaseolus lathyroides*, a shrubby legume from tropical regions, has been found to behave as a slender twining plant when associated with grasses, and indicates the necessity for imagination and insight when testing the suitability of new plants.

Research on Cancer

AMONG the numerous laboratories and institutions engaged in cancer research throughout the British Empire, none has a higher reputation than the Royal Cancer Hospital and its associated Chester Beatty Research Institute. We therefore welcome the republication in one attractive volume of a selection of papers which issued from these laboratories during the period 1935–39 (London: Royal Cancer Hospital (Free). 16*s*.). These had previously been published in many different journals in Britain and the United States, and their assembly will prove of great convenience to many workers in this field. Greatest importance will probably be attached to the series of papers by Prof. E. L. Kennaway and his colleagues on the synthesis and properties of carcinogenic compounds, which probably embodies the most notable contribution to cancer research during the last decade. Other valuable papers deal with the physical aspects of low-voltage, high-voltage and radium therapy and with topics concerning the pathology of cancers. The Institution is to be congratulated on this fine record of its work.

Venereal Disease Control

IN an address delivered at the Third Pennsylvania Health Institute (*Med. Rec.*, New York, Jan. 1943) Colonel Edgar Erskine Hume states that, during the War of 1914–18, General Pershing issued orders to the American Expeditionary Forces on the following lines: (*a*) education in sex hygiene and the nature and prevention of venereal diseases; (*b*) prophylaxis; (*c*) physical examinations; (*d*) repression of prostitution; (*e*) reporting sources of infection with dispensary treatment of infected civilians where possible; (*f*) court martial of men who contracted venereal disease; and (*g*) treatment of venereal disease at the front, thereby removing any possible temptation of men to become infected, and so get sent to the base. Although Pershing's programme did much good and was far in advance of that of any other country, seven million days of service were lost and a total of 338,746 soldiers were treated for venereal disease. In spite of the large number of cases, venereal disease is less prevalent in the army than in corresponding civil life. The rate of venereal disease in the United States Army has been reduced from 175 per 1,000 in 1904 to about 34 or 36, and has never been above 50 since 1926.

Murine Typhus in Bogotá

IN a preliminary note (*Bol. Of. San. Panam.*, 21, 1090; 1942) on this subject, Dr. Luis Patino-Camargo, director of the National Institute of Epidemiology and Medical Research at Bogotá, states that to date eight strains of the typhus rickettsia type have been found and classified in Colomba. He maintains that all these forms may be reduced to epidemic typhus, murine typhus and Tobia spotted fever. In three different places in Bogotá cases of typhus have occurred apparently caused by an endemic virus carried by fleas and maintained in wild rats. The writer, therefore, concludes that an intensive attack should be undertaken in Bogotá against these animals.

Standardization of Overhead Power Supply Lines

H. Willott Taylor and K. L. May, in a paper entitled "Standardization in Great Britain of Single-Circuit Overhead Lines up to 33 kV.", presented recently in London before the Institution of Electrical Engineers, consider that standardization can be done in a rational manner which will avoid any likelihood of stultification of new ideas; the preparation of suitable standard designs of overhead lines could be undertaken by a standing committee of the British

Standards Institution. Some of the Electricity Commissioners' regulations are reviewed with particular reference to their latest modifications for light lines. Details are given of the design evolved by the British Electrical and Allied Industries Research Association for light high-voltage lines up to 22 kV. which is now being considered by the B.S.I. With slight modifications, this design can be adaptable for 33-kV. working and also for heavier conductors. An alternative design, employing wood 'H' poles and suspension insulators, is suggested for special cases. A low-voltage design is also detailed and recommended.

The design covered by the draft B.S. specification is suggested for general adoption in Great Britain for high-voltage lines up to 22 kV. with conductors of 0·04 sq. in. or less. With minor modifications this design could also be used for the larger sizes of conductors and for 33-kV. working. To meet special local conditions, an 'H' pole suspension type of line could be provided. Standard designs for insulators, clamps, joints, stay rods, etc., should be prepared and be obtainable from any of the usual suppliers. A joint meeting between the supply undertakers and the railway companies should be arranged to consider whether modifications to the present standard conditions for railway crossings are not justifiable in the light of up-to-date experience. A discussion between supply undertakers and Post Office authorities is desirable, to determine whether the present somewhat onerous conditions required by the latter could not be modified considerably, and greater use made of 'joint user' poles.

Trade Unionism and Scientific Workers

UNDER the title "British Trade Unionism", the Association of Scientific Workers has issued a short study course for scientific workers prepared by Dr. J. Kuczynski and a study group of the Central London Branch, which was formed early in 1942, on trade union history with special reference to the development of non-manual organization and the history of the Association of Scientific Workers in particular. The booklet is in five chapters: why trade unions were formed in Great Britain and how they were developed; how scientific workers came to found a trade union; a short history of the Trades Union Congress; the structure of the Trades Union Congress; and the story of the Association of Scientific Workers. Of these the second and last show a certain lack of proportion and perspective. Within the limits imposed by pamphlet size, however, the first and the last three chapters give a concise—but biased, not to say prejudiced—account of the development of trade unionism in Great Britain and the association of professional defence organizations of scientific workers with this movement. Limitations of size, however, cannot excuse the paucity of the bibliography and the absence of bibliographic detail. The writers would do well to remember that history and propaganda are ill consorts.

Department of Scientific and Industrial Research: Appointments

THE Lord President of the Council has appointed Dr. A. Parker to be director of fuel research in the Department of Scientific and Industrial Research. Dr. Parker joined the staff of the Department of Scientific and Industrial Research in 1928 as assistant director of water pollution research. He had previously been engaged for some ten years on research for the gas industry, including full-scale experimental work, as senior research chemist to the Joint Committee of the University of Leeds and the Institution of Gas Engineers. Since the outbreak of War he has been acting-director of water pollution research. He has served for many years on the Council of the Institution of Chemical Engineers and has been a vice-president of the Institution.

Mr. E. Barnard has been appointed principal assistant secretary in the Department of Scientific and Industrial Research. Mr. Barnard joined the administrative staff of the Department in 1919, and has been director of food investigation since 1934.

Mr. R. O'F. Oakley and Mr. G. R. D. Hogg have been appointed assistant secretaries in the Department. Mr. Oakley joined the administrative staff of the Department in 1920, after previous Government service in the Patent Office. He became assistant to the director of fuel research in 1938, but since 1940 his services have been lent to the Ministry of Home Security as deputy chief adviser, Research and Experiments Department. Mr. Hogg joined the administrative staff of the Department in 1920, and was appointed establishment officer in the Department on the outbreak of the War.

Announcements

SIR HENRY DALE, president of the Royal Society and director of the Royal Institution, has been awarded the Harben Gold Medal by the Royal Institute of Public Health and Hygiene.

MR. P. I. DEE, University lecturer in physics in the University of Cambridge, has been appointed to the chair of natural philosophy in the University of Glasgow as from October 1 next. The chair becomes vacant by the retirement under the age limit of Prof. E. Taylor Jones.

THE Pilgrim Trust has purchased the residue of Newton's library which was being offered for sale (see NATURE, April 10, p. 416). Scientific workers and other students will welcome the news that this unique historical material will be preserved in Great Britain.

THE following have been elected officers of the Royal Astronomical Society for the ensuing year: *President*, Prof. E. A. Milne, Rouse Ball professor of mathematics, University of Oxford; *Treasurer*: Mr. J. H. Reynolds; *Secretaries*: Dr. H. R. Hulme, chief assistant, Royal Observatory, Greenwich; and Mr. D. H. Sadler, superintendent of the "Nautical Almanac"; *Foreign Secretary*: Sir Arthur Eddington, Plumian professor of astronomy, Cambridge; *Council*: Miss M. G. Adam, chief assistant (astronomy), University Observatory, Oxford; Dr. E. C. Bullard, Smithson research fellow of the Royal Society; Prof. J. A. Carroll, professor of natural philosophy, University of Aberdeen; Dr. T. G. Cowling, lecturer in mathematics, University of Manchester; Mr. F. J. Hargreaves; Dr. A. Hunter; Captain W. N. McClean; Dr. G. C. McVittie, reader in mathematics, University of London (King's College); Prof. L. M. Milne-Thomson, professor of mathematics, Royal Naval College, Greenwich; Mr. H. W. Newton; Mr. F. J. Sellers; and Mr. W. M. Witchell.

LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications.

Terminology in the Geological Sciences

DR. R. H. RASTALL[1] probably does not intend us to take too seriously his criticisms of geological and palæontological terminology, but his statement that "popular geology is being killed by pedantry" cannot be allowed to pass unchallenged. It is not very clear from his article whether he refers to the increasing refinement of modern geological studies or to the attempts to incorporate such details in elementary courses for students. He comments on the "enormous number of zones and sub-zones now recognized in several systems", but as he does not appear to question the validity of the subdivisions it is not clear what procedure he would suggest. That many such tables of zones are unsuitable for presentation to elementary students is accepted by most teachers of the subject, but these tables reflect an extension of knowledge, and Dr. Rastall agrees that against this "nothing can be said". Geology would indeed be a strange science if all its more recent advances could be incorporated directly into elementary courses.

Problems of terminology are particularly acute in geology, as in biology, but they also arise in any attempt at a simple or popular presentation of other sciences. In geology much can still be done with a minimum of unfamiliar terms, but in my experience, when a beginner's interest has once been aroused, the terminology is not a deterrent to more serious study. In fact, amateur geologists have themselves provided a good share of the zones and sub-zones and of other names which Dr. Rastall thinks are a deterrent to the popularization of geology. The readiness with which the necessary terminology of any subject is acquired by an interested amateur is seen among gardeners.

Many will join with Dr. Rastall in regretting that few field geologists are now able to name the fossils they collect. Although many field workers do in fact learn to recognize the most significant species occurring in their areas, it is not surprising that others find it simpler to leave most of this work to specialists, in view of the increase in our knowledge of fossil faunas and the degree of precision in identification which field workers now find essential for the elucidation of many structures of importance (for example, in the search for oil and coal).

The species problem as it affects the palæontologist has been much discussed recently, and those concerned with systematic work on fossils are alive to the difficulties which arise in the application of the Linnean system and of the International Rules of Nomenclature. But much as we may hope to see a revised system of nomenclature with an evolutionary basis, our knowledge is far too incomplete for this to be attempted in more than a few groups. Even so, whether we note our fossils under new names or by formulæ, original papers recording them will continue to be difficult to understand by those who have not made some effort to master the new terminology. The loss of familiar generic names such as Pecten, Terebratula and Rhynchonella from many lists is noted by Dr. Rastall, but I do not think that this need affect the elementary student. Glasgow students in their first year use the genera with their original wide significance, but if they continue to study the subject they seem to find no difficulty in replacing them by such terms as Terebratulid and Rhynchonellid, and in realizing that there is nothing inappropriate in the rather loose nomenclature of the elementary course.

So far as my experience is concerned, as a teacher in three universities and an examiner in four or five others, when elementary classes are considered, I do not believe that palæontological and stratigraphical terminology has in any way diminished the attraction of the subject. That any decline in numbers of geology students is largely to be attributed to changes in entrance requirements and in regulations for degrees and to the introduction of the Higher School Certificate in England is shown by the fact that at Glasgow (where these changes have not operated) there are even now almost two hundred students of geology. When students, in school or university, have the opportunity to learn geology, its attraction is felt as keenly as ever.

Finally, I would repeat the words which the distinguished American palæontologist Hyatt felt it necessary to use so early as 1867, "there is nothing to be dreaded in new names except by those who strive to get the animal kingdom by heart".

A. E. TRUEMAN.

University of Glasgow.

[1] NATURE, 151, 294 (1943).

WHILE one sympathizes with Dr. Rastall in his attempt to keep up to date in all branches of geological science[1], it should be pointed out that he has neglected three points in his survey of the problem.

(1) It is open to the field worker, now as ever, to name his own fossils. It is as easy to use the names of yesteryear as it ever was. The field worker, an essentially practical person, sends his fossils to the expert because precise determinations are useful to him, not from any superstitious respect for nomenclatorial 'mumbo-jumbo'. That a more refined nomenclature affords increased stratigraphical precision can scarcely be urged as an argument against such refinement.

(2) There is a fallacy in the contrast of petrological and palæontological nomenclature. Terms such as 'granite' and 'basalt' correspond to such terms as 'brachiopod' and 'graptolite'. The description of a particular granite would include a long chemical analysis, careful description of the mineral assemblage present and of its interrelation, and would then, and only then, correspond to the species of the palæontologist. If granites identical in all these respects occurred at many widespread points on the earth's surface, and had been described at different times, in different languages, by workers of all degrees of competence, then Dr. Rastall would find that definite laws, or rules of nomenclature, would be necessary in petrology, and the resulting names would appear strange and formidable to the outsider.

(3) No student need learn all the complicated nomenclature of palæontology. Using again the petrological analogy, a student could well be expected to learn and recognize a granite, and various types of this rock, but no one in his senses would hand him a specimen from, say, South America, and expect him to learn its chemical formula and most minute characteristics. Emphasis must be on characters common to all granites or to great groups among them. Similarly, in the teaching of palæontology, emphasis should be and is placed on the make-up and structure of classes, orders and families within

the great phyla, not on the recognition and retention, parrot-like, of minute differences between species. Often it will be found that such families practically correspond with the genera such as Ostrea, Pecten and Rhynchonella, for which Dr. Rastall has such a nostalgic sentiment, and here he is fighting the air, for teachers of palæontology have long since complied with the spirit of his plea.

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[1] NATURE, 151, 294 (1943).

ON a minor point the two foregoing letters are contradictory. Dr. Wood says a field geologist can name his own fossils, while Prof. Trueman admits that he cannot. Only a palæontologist can decide this.

Dr. Wood's remarks on granite are really irrelevant. If, instead of basalt and granite, names chosen as known to everybody, I had written, for example, "umptekite Ramsay" and "jocupirangite Derby", his argument would have no bearing on the subject.

I can assure Prof. Trueman that my article was meant to be taken very seriously. I do not suggest that the decline of geology as an academic subject and a popular hobby is due solely to pedantry, but generally to the crushing burden of a complicated nomenclature. As an example of pedantry, which is near akin to priggishness, I instanced the habit of quoting the authority for a fossil every time. If space allowed, I could quote a scathing paragraph on this subject written in 1899 by Prof. Charles Lapworth. Only the last sentence can be given here. "Such vain repetition can only add unnecessarily to the amount of the printer's bills, and increase what is amply sufficient for scientific purposes, the vanity of the species maker himself."

The main object of my article was to protest against the incessant multiplication of new *generic* names founded usually on minute differences and obscuring genetic relationships. This I regard as obscurantist and anti-evolutionary. A French physicist has well written, "Nature is a workshop, not a museum", and the object of research should be to discover her methods and her tools. But palæontology has now become a chaotic mass of disconnected names. To paraphrase a famous saying of Henri Poincaré, a card index is not a science, any more than a dictionary is a language.

R. H. RASTALL.

Mode of Chemical Action of X-Rays on a Non-Aqueous Solution

DALE, Meredith and Tweedie[1] have recently shown that the mode of action of X-rays on certain dissolved enzymes, similarly to the action on aqueous ferrosulphate[2] and on aqueous hæmoglobin[3], is in agreement with the 'indirect action' mechanism[3] as opposed to the 'direct hit' mechanism. It appears that the ionizing radiation activates the water and that the activation products in turn react with the enzyme. Hydrogen peroxide has previously been identified as one product of the irradiation of water[4].

It may be interesting to compare the results of Dale *et al.* with those of some (unpublished) experiments in non-aqueous solution, which were carried out at the Institute of Physical Chemistry, University of Berlin, during 1931-32, but could not be completed owing to the political changes in Germany. The object was to show whether what is now called the 'direct hit' mechanism applies to solutions of X-ray sensitive substances in non-sensitive solvents, that is, in solvents which, when used alone, are not activated. In such solvents radiation energy would not be stored. 'Direct hit' reactions should be of the first order both with regard to X-ray dosage and to concentration; on the other hand, the rates of reactions of the type described by Dale *et al.* can in extreme cases be independent of concentration.

First an attempt was made to measure the decomposition in organic solvents of benzophenone diazide $(C_6H_5)_2C(N_3)_2$, a substance previously studied as a solid[5]. Unfortunately, the nitrogen liberated in the solution could not be measured with any accuracy owing to supersaturation. However, success was achieved with a solution of ammonium persulphate in practically anhydrous glycerine. The solution was contained in a cylindrical glass tube 2 cm. long and 1 cm. wide (volume very nearly 1·5 c.c.) which was mounted in a fixed position about 2 cm. from the window of the X-ray tube. The rays were produced in a gas tube with molybdenum anticathode, filtered through zirconium oxide and aluminium, and had an effective wave-length of 0·8 A. They entered the glass vessel through its extremely thin concave base[6]. The concentrations before and after irradiation were determined iodometrically. Glycerine by itself was not affected. In a preliminary run it was ascertained that at constant concentration the yield is proportional to dosage, if irradiation was interrupted before the concentration decreased markedly.

In the accompanying table concentrations are given in mgm./c.c. and dosages in arbitrary relative units, each unit representing 1 m-amp.-hour; voltage (40 kV.) was kept constant. The variation with increasing concentration of the absorbing and scattering properties of the solutions will not materially change the energy available.

Concentration	Dosage	Mgm. decomposed	Percentage decreases per unit dosage
109	67	2·5	0·023
150	51	2·5	0·022
190	87	3·3	0·013
263	70	6·8	0·025
381	68	7·8	0·020
382	81	9·8	0·021
Solid	>100	0	0

The constancy of the last column shows that in the range investigated the yield per dosage unit is proportional to concentration; that is, the reaction is of the first order with regard to persulphate concentration. The lack of effect on the solid seems to show that the decomposition proceeds in several stages and that a medium is required to prevent reformation of ammonium persulphate from a primary product.

While the results of Fricke and of Dale *et al.* indicate that in aqueous tissues yields are generally less than proportional to concentration, the above experiment demonstrates that this need not be so in non-aqueous (for example, lipoidal) tissue.

This work was undertaken on the initiative of Prof. P. Günther, who devoted much attention to it.

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[4] Risse, O., *Z. physik. Chem.*, A, **140**, 133 (1929); Risse, O., *Fortschr. Röntgenstr.*, **46**, 62 (1932).
[5] Götzky, S., Günther, P., and Cronheim, G., *Strahlentherapie*, **43**, 379 (1932).
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Quenching of Fluorescence by Nitric Oxide

IT is known that the fluorescence of many hydrocarbons and particularly of the polycyclic hydrocarbons in solution is often strongly quenched by molecular oxygen[1,2]. We have now investigated several other gases with regard to their quenching effect towards polycyclic hydrocarbons.

Carbon monoxide and nitrous oxide are without any measurable effect. On the other hand, nitric oxide, which in many respects resembles molecular oxygen, shows a strong quenching of the fluorescence of, for example, anthracene, benzpyrene or methylcholanthrene in various solvents, such as hexane, ethanol, etc. The effectiveness of a particular solvent again depends primarily on the solubility of nitric oxide in it. As in the case of oxygen, this quenching effect is completely reversible if the nitric oxide is replaced, for example, by pure nitrogen. This can again be taken as some evidence for a reversible oxidation and reduction system in these cases[2].

Just as in the case of oxygen, where it is possible to obtain the photochemical formation of a peroxide under suitable conditions, prolonged ultra-violet irradiation of these hydrocarbon solutions in an atmosphere of nitric oxide probably leads to the formation of what may be termed nitroxides $(C_nH_m)NO$ analogous to the peroxides $(C_nH_m)O_2$.

It seems that these nitroxides are even less stable than the peroxides and cannot usually be separated as such, but we have obtained several crystalline nitrogen-containing compounds, as a result of the photochemical reaction, which are presumably products of secondary irreversible changes of the primarily formed nitroxides.

A full account will be published elsewhere.

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[1] Bowen, E. J., and Williams, A. H., *Trans. Faraday Soc.*, **35**, 765 (1939).
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Determination of the Water Content of Wood and other Substances by means of Ternary Azeotropic Mixtures

IT is peculiarly difficult to dry certain substances and to determine the water in them because (*a*) if liquids they may form inconvenient mixtures of constant boiling point (azeotropic) with water, (*b*) if solids they may retain water of crystallization, form syrups, or be susceptible to oxidation, or (*c*) their structure and colloidal state may hinder the loss of water, as in wood, peat, etc. One well-known method is to distil after adding a liquid immiscible with water; the distillate settles into two layers and the volume of water is measured.

Young and Fortey[1] used fractional distillation for quantitative analysis of liquid mixtures and obtained anhydrous ethyl alcohol by distillation with benzene. All water is removed in the ternary azeotropic mixture which boils at 64·85°, and has 74·1 per cent benzene, 18·5 alcohol and 7·4 water. The alcohol benzene binary boils at 68·24°. With this procedure Atkins and Wilson[2] obtained anhydrous solids, lævulose, maltose and starch, suspended in benzene.

The method can be used for quantitative determination of water in a solid, since the anhydrous alcohol abstracts the water which distils over in the ternary. Conditions laid down by Young[3] for liquid mixtures should be observed, and accuracy checked using known weights of water. Disappearance of turbidity in the condenser indicates the complete removal of this addition. Accuracy is increased by the fact that the ternary mixture weighs more than thirteen times as much as the water in it. Other ternary mixtures contain even less water. Hill[4] obtained one boiling at 61·8° and consisting of carbon tetrachloride 86·3, alcohol 10·3 and water 3·4 per cent; the corresponding binary boils at 65·2. Atkins[5] found one boiling at 65·7 with carbon tetrachloride 76·9, methyl-ethyl-ketone 20·1 and water 3·0 per cent. The binary boils at 73·8°, giving good separation. Both ternaries are less inflammable than the one with benzene. They are also more sensitive, since they weigh, respectively, more than twenty-nine and thirty-three times as much as their water content. An eight-section Young evaporator still head was used throughout.

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Marine Biological Laboratory,
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March 31.

[1] Young, S., and Fortey, E. C., *J. Chem. Soc.*, **81**, 752 (1902).
[2] Atkins, W. R. G., and Wilson, E. G., *J. Chem. Soc.*, **107**, 916 (1915).
[3] Young, S., "Fractional Distillation" (London, 1903).
[4] Hill, T. H., *J. Chem. Soc.*, **101**, 2467 (1912).
[5] Atkins, W. R. G., *J. Chem. Soc.*, **117**, 216 (1920).

Onset of Fibrillation in Denervated Muscle

RECENT studies of the phenomenon of fibrillation in denervated muscle have shown that it is subject to considerable variation. Since this phenomenon is becoming of increasing importance in the diagnosis and prognosis of nerve injuries, we feel that the following observations should be recorded.

We have found that, in laboratory mammals and man, fibrillation invariably occurs provided the denervated muscle is maintained at body temperature. We have found, also, that the time of onset of fibrillation following denervation of voluntary muscles varies according to the size of the mammal. In the mouse, fibrillation commences 3½ days after nerve section; in the rat 4½ days; in the rabbit (small) 6 days, (large) 8 days; in the monkey (*Mac. mulatta*, small adult) 8 days, and in man (11 stone) 18 days. These differences may be related to the metabolic level, for we have observed that the onset in thyroidectomized rabbits is delayed until the fourteenth day. In the light of these observations, muscles in man have been investigated by means of electromyography following peripheral nerve injuries. It has been found possible to record fibrillation following denervation, partial or complete, if the lower motor neurone is divided anywhere between the anterior

horn cell and the periphery. It is easy to distinguish the action potentials of motor unit activity from those of fibrillation, and this distinction is proving of definite use in clinical diagnosis and prognosis[3].

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Dept. of Human Anatomy, B. FEINSTEIN.
The University, R. E. PATTLE.
Oxford.
March 27.

[1] Adrian, E. D., and Bronk, D. W., *J. Physiol.*, **67**, 119 (1929).
[2] Denny-Brown, D., and Pennybacker, J., *Brain*, **61**, 311 (1938).
[3] Weddell, G., Feinstein, B., and Pattle, R. E., *Lancet*, 236 (1943).

Science, Common Sense and Decency

WHEN a man of science deals with subjects outside his special sphere the result is always interesting, but not always illustrative of the caution and rigour of the scientific method. It is rather startling to find Dr. Irving Langmuir declaring (see NATURE, March 6) that "Reason is too slow and difficult", and adding that when we do not possess the necessary data or when we find a problem too complex for the methods of reasoning we must use "common sense, judgment and experience" and should not underrate the importance of intuition. Surely common sense (carefully controlled), judgment and experience are factors in the process of reasoning? As for intuition, the example given by Dr. Langmuir is this: "In almost every problem which I have succeeded in solving, even those that have involved days or months of work, the final solution has come to my mind in a fraction of a second by a process which is not consciously one of reasoning". Can this culmination of days and months of concentration be properly described as intuition? Or are we to conclude that Dr. Langmuir's concentration on the problems of physics has prevented him acquiring any knowledge, even intuitive, of unconscious cerebration?

Dr. Langmuir's conceptions of the psychology of reasoning will prepare biologists for his confession that he finds the idea of fitness to survive "inherently rather fuzzy".

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SOME of Dr. I. Langmuir's ideas on modern trends in scientific thought[1] require comment.

It is significant, I think, that the resurgence of metaphysics, spiritualism, etc., among scientific men has been mostly confined to physicists. Their entities —atoms, electrons, quanta—are all things which cannot be observed directly by the senses, so perhaps we can understand their doubt as to the relation of their concepts to reality. On the other hand, their knowledge of the biological sciences is not usually such as to give them that confidence in the power of scientific method which is pronounced in modern biologists.

It is important to distinguish clearly between concept and reality. The chemist's 'atom' may differ from the physicist's 'atom', but both are only aspects, imperfectly understood, of a real material atom. As science progresses the gap between concept and reality decreases, but only ideally can they coincide. The uncertainty principle, for example, is a concept which has no bearing, as Dr. Langmuir would suggest, on the *reality*, which is that at any moment a particle has both a definite position and a definite velocity, and that both are determined by its external and internal conditions.

That physicists have been unable to find immediate causes for the emission of an alpha particle from a certain radium atom is no reason for asserting that such emission is without cause. It is at present impossible to predict which side up a penny will fall, but it is actually determined by which is the original side up and the number of somersaults the penny makes before coming to rest. Owing to man's common sense, he has searched for a cause for everything; where his knowledge has failed him he has substituted the supernatural. Dr. Langmuir would have us substitute nothing, and declares such phenomena to be beyond the bounds of science. This is not a very happy philosophy for the dawn of the scientific era.

Divergent phenomena are, by Dr. Langmuir's definition, large effects produced from small beginnings. We are told these phenomena do not obey the laws of cause and effect. The very use of the word 'produced' implies causation. The establishment of a mutation in a population through natural selection is an example of such a phenomenon. It can be seen that 'divergent' phenomena are merely the expression of improbable events due to their coincidence with the correct environment for that expression.

Classical and quantum physics are two aspects of the same reality studied on different scales. Mass effects are the statistical integration of an internal conflict between probabilities. This internal conflict is universal in all phenomena from the physical to the sociological. Just as the unit which shows heterogeneous behaviour is in physics the atom or energy quantum, so in sociology it is the individual, and one can induce laws of society, ignoring individual idiosyncrasies.

A. J. BATEMAN.
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London, S.W.19.

[1] NATURE, **151**, 286 (1943).

Czechoslovak Medical Students at Oxford

IN connexion with the historic ceremony at Oxford on February 27 when Czechoslovak medical degrees were conferred on twenty-three Czechoslovak medical students, it is of interest to recall that on February 25, 1586/7, Wencelaus (Václav) Lavinius (that is, Lavický), a Moravian who had studied medicine for twenty years in France, Germany and Italy, and had been licensed to "incept in medicine" at Wittenberg "sub Pensero", was admitted as M.D. of Oxford on condition that he gave three "solennes lectiones" before his departure[1]. He had presented letters of introduction from Sir Francis Walsingham, and from Massionius Fontanus and J. Castolus, "pasteurs" of the French church in London. Castolus's letter stated that Lavinius had spent a year in London, had brought a letter of introduction from Beza of Geneva, and that he was "rector peregrinationum et familiæ præfectus" of Baron di Zerotini (that is, z Žerotin), a Moravian.

R. FITZGIBBON YOUNG.

[1] For references see R. Fitzgibbon Young, *English Hist. Rev.*, Jan. 1923.

THE BRITISH EMPIRE CANCER CAMPAIGN

ANNUAL REPORT

THE nineteenth annual report of the British Empire Cancer Campaign, which was recently issued, is much thinner than reports of previous years. It is, however, much condensed, and the usual index and many lists of names have been omitted. All the cancer research centres in Great Britain appear to be still carrying on, so that in the future it should be possible for the work to expand and to make rapid progress.

Virus Research

Pure lines of fowls have been used to advantage in the study of avian tumours at the Middlesex Hospital, London. A strain of Plymouth Rock fowls is very susceptible to the action of carcinogenic agents, while a strain of Brown Leghorn fowls is resistant to such agents and also readily forms antibodies to the Rous sarcoma virus. The variability in susceptibility of Brown Leghorn fowls to the virus is reflected in their ability to produce neutralizing antibodies and agglutinins. The antibodies present, however, may be ineffective in preventing the subsequent growth of tumours. This is probably due to the growth of the tumour cells coupled with increase of virus within the growing cells, in such a way that the virus does not come in contact with the circulating antibodies. Immunity to filterable tumours therefore is less certain than immunity to other virus diseases.

Dr. M. H. Salaman, of St. Bartholomew's Hospital Cancer Research Department, working with Dr. D. E. Lea, has studied the action of X-rays on vaccinia virus elementary bodies. The particles contain only a small amount of radio-sensitive material, but this is dispersed throughout the volume of the elementary bodies. In contrast to this animal virus, the radio-sensitive part of a crystallizable plant virus occupies almost the whole of the volume of the particles. Photomicrographs of vaccinia elementary bodies taken by means of an electron microscope show that they are oval in shape.

Carcinogenic Action

The possible carcinogenic effect of heated fats has been further investigated at the Glasgow Royal Cancer Hospital. When rats were fed on a diet of bread, milk, water and heated fats, non-malignant ulcerated papillomata developed in the stomachs of some animals. Since white bread ceased to be available, the rats have been given National bread and no papillomata have been seen.

Workers at the Royal Cancer Hospital are preparing and testing compounds for carcinogenic action and growth-inhibitory power with the object of finding new substances worthy of therapeutic trial.

Dr. I. Berenblum suggests that injected benzpyrene must remain unchanged in the tissues for some time if it is to produce tumours. If benzpyrene is injected subcutaneously, it remains at the site of injection for some time and tumours are formed. If it is injected into the peritoneum, it disappears rapidly and no tumours result. Less than one per cent of injected benzpyrene is excreted as unchanged material, but a considerable amount is excreted as a monohydroxy derivative. Dr. I. Berenblum and Dr. R. Schoental have now isolated benzpyrenequinone from the faeces of rats which had been injected previously with benzpyrene. This quinone is possibly derived from a dihydroxy compound.

Benzpyrene in true solution has a violet fluorescence, but in the animal body it is converted into *BPX*, which has a blue fluorescence; *BPX*, in the presence of intestinal contents, is changed into a substance with a green fluorescence. Prof. F. Weigert and Dr. I. Doniach at the Mount Vernon Hospital have observed a violet fluorescing wave passing down the alimentary tract of mice which had been given benzpyrene by mouth. The benzpyrene was absorbed so that the violet fluorescence spread to the fatty tissues, and afterwards a blue fluorescence was seen in the kidney and *BPX* appeared in the bile. When the common bile duct was ligated, the blue fluorescing *BPX* was unable to pass into the intestine but accumulated in the plasma and was deposited in the lung, liver and intestinal wall. *BPX* was not absorbed from the gut. These observations amplify results obtained in this field both in Glasgow and Oxford.

Dr. J. C. Mottram reports that carcinogenic hydrocarbons caused some hæmolysis of erythrocytes in isotonic saline, but the same hydrocarbons increased the resistance of the cells to hæmolysis in hypotonic solutions. These effects were much reduced if proteins were present, and it is suggested that the protective action of proteins may account for the failure of carcinogens to induce cancer cells in tissue culture.

Heredity

The experiments of Andervont and of Bittner in America have shown that a factor influencing the incidence of breast cancer in mice is transmitted from mother to offspring through the milk. This factor is present in the milk of mice from strains with a high incidence of breast cancer. Dr. G. M. Bonser has been able to demonstrate the effect of the factor in male mice. Male mice of the *CBA* strain, in which the incidence of breast cancer even in females is low, have developed tumours of the breast following injection of triphenylethylene only when they have been suckled by mice of the *R* III strain. On the other hand, the incidence of breast tumours in mice of the *R* III strain, which is usually high, was reduced if they had been suckled by *CBA* mice.

Successful experiments on cross-fostering have also been carried out at Newcastle-on-Tyne, where Dr. F. C. Pybus and Dr. E. W. Miller increased the incidence of breast tumours in *CBA* female mice from 5 per cent to 60 per cent by allowing them to be suckled by mice of the Simpson strain. Further confirmatory evidence of the existence of this extra-chromosomal factor has also been obtained at the Marie Curie Hospital.

An examination of the incidence of cancer in the mothers and sisters of patients suffering from breast cancer, made by Miss L. M. Wainman in Leeds, shows the incidence to be no higher among the relatives of the patients than in the general population. This result is of interest, particularly as it is different from the findings of Wassink in Holland. As most infants are suckled, the present observations indicate that, in the section of the population examined, there is not likely to be a factor influencing the incidence of breast cancer transmitted through human milk.

Radiations

Mouse tumours have been irradiated with neutrons in order to determine the amount of radiation which is necessary to produce tumour regression. This work, carried out at the Mount Vernon Hospital, shows that the neutron dose is only one-twentieth to one-thirtieth of the X-ray dose which would be required to produce the same response.

Dr. J. S. Mitchell has photographed tissues, before and after irradiation with X-rays, using ultra-violet light of wave-length 2537 A. The absorption of light of this wave-length by the cytoplasm increases on irradiation, and this has been shown to be due to accumulation of nucleotides. There is no comparable increase in nucleic acid content of the nuclei, and it is suggested that X-rays inhibit the reduction of nucleotides to desoxynucleotides and so prevent the formation of nucleic acid.

Growth Factors

Extracts of bacteria and of some fowl tumours contain a growth-stimulating factor which reduces the delay in the growth of *Staphylococcus aureus*. Prof. H. N. Green and Dr. F. Bielschowski have been able to concentrate the factor and show that it has the properties of a weak acid. The same workers have examined some derivatives of the carcinogenic insecticide, 2-acetylaminofluorene. The growth of rats and of bacteria was inhibited by 2-aminofluorene. These results indicate that the factors which govern the growth of bacteria and of tumours may be similar.

Clinical Research

An analysis has been made of the histological findings from specimens obtained from mastectomies carried out at the Middlesex Hospital over a sixteen-year period. Nineteen cases of malignant disease in the male breast were found. Only three cases of extensive non-malignant epithelial overgrowth in males were seen, and of these two were from men who had worked with stilbœstrol.

The Clinical Cancer Research Committee has now analysed the data from four hundred and seventy-three cases of carcinoma of the œsophagus. The prognosis for this form of cancer is bad; only thirty-four of the patients were known to have survived for more than a year after the original diagnosis had been made.

The British Empire Cancer Campaign would be doing useful work if it were merely able to keep the various cancer research institutions just 'ticking over'. It is, however, doing much more than this, as the present report amply shows. E. BOYLAND.

CONTROL OF RAW MATERIALS

THE report on the work of the Combined Raw Materials Board to January 26, 1943, which has recently been issued over the signatures of the two members of the Board, Mr. W. L. Batt, vice-chairman of the War Production Board, United States, and Sir Clive Baillieu, head of the British Raw Materials Mission in the United States, outlines the measures taken since the Board was set up on January 26, 1942. The report demonstrates that international co-operation on a large scale and on a day-to-day level can be markedly successful in getting the resources of each country used to the best common advantage. Without combined machinery, the settlement of each joint problem as it arose through contacts which would not continue after their purpose had been achieved, and which would not provide experience and knowledge to be applied to other problems, would inevitably have been surrounded with difficulties and obstacles involving delay, uncertainty and dissatisfaction. As it is, very real progress has been possible towards a planned and expeditious utilization of the combined raw material resources in the prosecution of the War.

The Board's primary duty was to bring under authoritative review the combined supply and requirements position for those materials which are in such limited or precarious supply as to endanger any part of the total war effort. The materials selected for review were those for which there was *prima facie* evidence for concern. Initially, they were materials of which the supply had been affected or threatened by enemy action in the Far East, such as rubber, silk, tungsten, tin and manila hemp and sisal. In other cases, for example, the principal non-ferrous metals, it was important to take all necessary precautions in view of the unprecedented demands which the combined military programmes were imposing upon normal sources of supply. In a third class were materials which gave rise to operating or purchasing problems where both the United States and Great Britain, together with others of the United Nations, might be in active competition in the various markets for limited supplies.

The common factor in all the Board's materials reports is that it has provided for the first time, through combined machinery not previously in existence, an official assessment of the total position. The reports draw together in one document a combined statistical survey of requirements and supply for one or two years ahead; a review of possible interruptions to future supply, and of measures in progress or desirable to increase output; and a consideration of the problems of conservation and substitution. The Board exercises its authority through recommendations to the departments and agencies of the American and the British Governments already responsible for the supply and distribution of raw materials within their fields, and based on its reports these recommendations have been directed towards balancing supply and demand through allocations, maintenance or increase of supply, conservation and economy in use, co-ordination of the purchasing and development activities of the two countries in the various markets and shipping adjustments.

For most materials the maintenance and stimulation of output is a matter of fundamental concern, and for such materials as rubber, copper, tin, nickel, cobalt, tungsten, mica, zinc, balsa and sisal, the Board has gone considerably beyond general indications and has made specific recommendations as to the places at which development should be undertaken and the methods or organization which should be used. In regard to conservation, the principal direct contribution of the Board has been to secure and co-ordinate exchanges of technical information and experience. This action has brought in so far as possible the other United Nations, and such exchanges

have been of particular importance where the more liberal use of a scarce material in one country than in another is due, at least in part, to undeveloped technical processes and equipment. Recommendations made on this point in connexion with tungsten, tin, cobalt, mica, copper, zinc, graphite and asbestos have in some instances been reinforced by an advisory interchange of technicians. A special liaison has been set up to centralize the activities of the Board in a field covering a wide variety of commodities, and particularly to provide a defined channel for the exchange of information on matters of conservation.

Liaison has throughout been maintained with the parallel Combined Boards, and a Joint Advisory Committee has been set up with the Combined Food Board for questions relating to fertilizers. The Combined Production and Resources Board has been provided with a statement of the estimated supply to the end of 1943 for steel ingots and the key materials aluminium, rubber and copper, as well as with combined supply requirements summaries for some twenty-four materials actually or potentially in such short supply as to endanger any part of the production programme.

In regard to collaboration with others of the United Nations, through machinery already developed by the State Department and the Board of Economic Warfare in Washington and by the British Commonwealth Supply Council in London, as well as by direct discussions and negotiations, the resources of Central and South America, the Belgian and French overseas territories, the British Commonwealth and friendly neutrals have been and are being mobilized. For the U.S.S.R. requirements are covered in the Protocol Agreements in amounts which are adopted by the Board in any general allocations. Discussions have taken place between representatives of the U.S.S.R. and Britain and the United States with regard to the supply of certain materials from Russia.

With the passing of a greater range of materials into the category of "short or critical supply", it became necessary for the two countries closely to co-ordinate the planning of their export programmes involving such materials. A Combined Export Markets Committee was therefore set up under the auspices of the Board to watch over the export programmes of both countries for certain scarce materials, to ensure that the requirements of the importing countries are, so far as possible, met, but on a carefully controlled assessment of essential needs comparable to that obtaining in the United States and Great Britain. On this basis the Committee agrees upon joint export programmes in the light of the other factors involved—shipping, labour, political and financial considerations, maintenance of normal channels of trade, etc.

The report thus shows that the Board has been able to exercise its function of planning the raw materials side of the combined war effort in three principal ways. First, agreement has been secured, through the Board, between the two Governments concerned, to common action in regulating supply, distribution and use of the major strategical materials, with the object of ensuring that each country is put in a position to make its maximum contribution to the war effort on the production side. Secondly, by bringing the authorities of the two countries together in co-operative arrangements for purchasing and supply, a scramble has been prevented for those 'secondary' materials which are, in their place, essential to the production programmes. Thirdly, the Board and its machinery have formed a centre for the discussion of day-to-day problems affecting either country, and for the compilation of information and evidence on which alone an effective solution for those problems can be based. The extent to which those facilities have been freely and fully used by the Governments concerned, and the fact that although the Board has no executive authority its recommendations have never been disregarded, offer the strongest justification for the hope that this machinery of joint control over world-wide resources will be continued and given wider scope to prevent a wild scramble for the diminished supplies after the War, frustrating our hopes for the most fruitful use of the world's resources in recovery.

AIR-BLAST CIRCUIT-BREAKERS

A PAPER read in London on March 4 before the Institution of Electrical Engineers by A. R. Blandford discusses notable improvements in circuit-breaker design with reference to the reduction in oil quantities and to its elimination.

The trend in the design of modern high-power circuit-breakers has always been in the direction of reducing the quantity of oil necessary for arc interruption. A decided step in this direction was the introduction of the arc-control device which confined the arc within an arcing chamber surrounding the contacts during arc interruption. The application of such devices, which usually take the form of a small container of liquid with restricted venting enclosed in the main containers of liquid, made possible a considerable reduction in oil quantity, particularly at the higher voltages. More recently, there has developed a strong demand for oil-less circuit-breakers.

Other forms of circuit-breakers using various extinguishing media have been developed, but only the two forms, oil and air-blast, have found general favour, and of these the growing popularity of the latter is accounted for by a proper appreciation of its superiority in principle of operation and behaviour. The inherent advantages in their order of merit are freedom from explosion, elimination of oil-fire hazard, mechanical simplicity, suitability for duties requiring frequent operation, cleanliness of maintenance and operation, reduced maintenance, and facility for power closing.

The principle of the axial blast can be applied readily to voltages from 6·6 kV. upwards at standard ratings. The question of susceptibility to rates of rise of recovery voltage can be overcome with ease by the incorporation of parallel resistors, which also limit harmful over-voltages. Air-blast breakers provide freedom from the dangers of explosion and they eliminate fire hazard completely. They are positive in operation and result in minimum arcing times at all values of current. They sustain a minimum deterioration of contacts, resulting in long life for repetitive operation. 'Making' contacts are exposed for ease of inspection. Clean and speedy inspection of arcing contacts is possible, only about three minutes being required to dismantle and inspect one interrupting chamber. Large-capacity batteries with their problems of regulation for closing purposes are eliminated.

FORTHCOMING EVENTS

Saturday, April 17

BRITISH RHEOLOGISTS' CLUB (JOINT MEETING WITH THE MANCHESTER AND DISTRICT SECTION OF THE INSTITUTE OF THE RUBBER INDUSTRY) (at the Engineers' Club, Albert Square, Manchester), at 10 a.m.—Discussion on "The Rheology of Rubber and Rubber-like Materials" (Chairman: Mr. W. N. Lister).

Monday, April 19

INSTITUTION OF ELECTRICAL ENGINEERS (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Discussion on "Infra-red Lamp Heating and its Application to Industrial Purposes".

Tuesday, April 20

ROYAL STATISTICAL SOCIETY (at the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2), at 5.15 p.m.—Mr. R. J. Thompson: "The Future of Agriculture".

INSTITUTION OF ELECTRICAL ENGINEERS (WIRELESS SECTION) (at Savoy Place, Victoria Embankment, London, W.C.2), at 5.30 p.m.—Discussion on "Metal Rectifiers and their Applications to Radio and to Measurements" (to be opened by Mr. S. A. Stevens).

Wednesday, April 21

ROYAL SOCIETY OF MEDICINE (at 1 Wimpole Street, London, W.1), at 2.15 p.m.—Annual General Meeting. Discussion on "Immunity", 5. "Immunity to Viruses" (to be opened by Sir John Ledingham, C.M.G., F.R.S., Mr. T. M. Doyle, Mr. J. T. Edwards and Mr. N. Dobson).

ROYAL METEOROLOGICAL SOCIETY (at 49 Cromwell Road, South Kensington, London, S.W.7), at 4.30 p.m.—Meteorological Sound Films: (1) "Ice Formation"; (2) "Temperature and Pressure"; (3) "Synoptic Meteorology"; (4) "Tactical Use of Clouds"; (5) "Fog". (By courtesy of the Air Ministry.)

APPOINTMENTS VACANT

APPLICATIONS are invited for the following appointments on or before the dates mentioned:

SPEECH THERAPIST—The Director of Education, Education Offices, Peel Street, Huddersfield (April 24).

ASSISTANT TEACHER OF MATHEMATICS AND SCIENCE in the Oldbury Technical School—The Director of Education, County Buildings, Worcester (April 24).

ASSISTANT MASTER TO TAKE SCIENCE AND MATHEMATICS in the Junior Technical School—The Director of Education, Education Offices, Union Street West, Oldham (April 24).

TEACHER OF MINING SUBJECTS in the Doncaster Technical School—The Chief Education Officer, Education Offices, Wood Street, Doncaster (April 26).

RESEARCH ASSISTANT—The Secretary, Animal Diseases Research Association, Moredun Institute, Gilmerton, Midlothian (April 26).

ASSISTANT LECTURER IN AGRICULTURAL CHEMISTRY—The Registrar, The University, Leeds 2 (April 28).

TEACHER OF SCIENCE SUBJECTS (PHYSICS AND CHEMISTRY) in the Batley Technical College and School of Art—The Director of Education, Education Offices, Batley, Yorks. (April 28).

PHYSICIST (MALE) TO THE RADIOTHERAPY DEPARTMENT—The Secretary, London Hospital, London, E.1 (April 30).

BOROUGH ELECTRICAL ENGINEER—The Town Clerk, Town Hall, Luton (May 1).

TEACHER OF BUILDING CONSTRUCTION, SCIENCE AND MATHEMATICS in the Building Trades and Junior Day Department of the Oxford Schools of Technology, Art and Commerce—The Chief Education Officer, City Education Offices, 77 George Street, Oxford (May 1).

LECTURER IN MINING AND FUELS—The Principal, Huddersfield Technical College, Huddersfield (May 7).

LECTURER (WOMAN) IN GEOGRAPHY in the Brighton Municipal Training College—The Education Officer, 54 Old Steine, Brighton (May 8).

GRADUATE LECTURER IN MATHEMATICS AND SCIENCE—The Clerk to the Governors, Technical College, Chesterfield.

SPEECH THERAPIST—The Education Officer, County Hall, Wakefield.

SECOND ASSISTANT PORT ENGINEER for the Basrah Port Directorate, Iraq Government—The Secretary, Overseas Manpower Committee (Ref. 541), Ministry of Labour and National Service, Sardinia Street, Kingsway, London, W.C.2.

MECHANICAL AND ELECTRICAL ENGINEER for the Gold Coast Government Public Works Department—Ministry of Labour and National Service, Central (Technical and Scientific) Register, Section D.588, Alexandra House, Kingsway, London, W.C.2.

ASSISTANT MECHANICAL ENGINEER for the Tanganyika Government Railway—Ministry of Labour and National Service, Central (Technical and Scientific) Register, Ref. C.1334, Alexandra House, Kingsway, London, W.C.2.

LECTURERS IN MECHANICAL AND ELECTRICAL ENGINEERING SUBJECTS—Ministry of Labour and National Service, Central (Technical and Scientific) Register, Section D.565, Alexandra House, Kingsway, London, W.C.2.

ASSISTANT MASTER, WITH GOOD QUALIFICATIONS IN ELECTRICAL ENGINEERING, at the Maidstone Technical Institute—Mr. A. W. Peacock, 13 Tonbridge Road, Maidstone, Kent.

REPORTS and other PUBLICATIONS

(not included in the monthly Books Supplement)

Great Britain and Ireland

Tin Research Institute. Publication 115: Determination of the Thickness of Tin Coatings. Pp. 6. (Greenford: Tin Research Institute.) [253

British Rubber Producers' Research Association. Publication No. 20: The Elasticity of a Network of Long-chain Molecules, 1. By L. R. G. Treloar. Pp. 8. (London: British Rubber Producers' Research Association.) [226

National Institute of Economic and Social Research. Occasional Papers, 2: The Population of Bristol. By H. A. Shannon and B. Grebenik. Pp. v+93. (Cambridge: At the University Press.) 7s. 6d. net. [226

Proceedings of the Royal Irish Academy. Vol. 48, Section A, No. 4: Dynamics and Scattering Power of Born's Electron. By Erwin Schrödinger. Pp. 91–122. 1s. 6d. Vol. 48, Section A, No. 5: On Ideals in the Cayley-Dickson Algebra. By K. Mahler. Pp. 123–134. 1s. Vol. 48, Section A, No. 6: Pentads, Tetrads and Triads of Meson-Matrices. By Erwin Schrödinger. Pp. 135–146. 1s. Vol. 48, Section B, No. 8: Mean Geochemical Data in relation to Oceanic Evolution. By E. J. Conway. Pp. 119–160. 2s. Vol. 48, Section B, No. 9: The Chemical Evolution of the Ocean. By E. J. Conway. Pp. 161–212. 2s. 6d. Vol. 48, Section B, No. 10: The Mobile Colloidal Humus of Podsolic Soils and its relationship to the Process of Podsolisation. By Patrick H. Gallagher. Pp. 213–230. 1s. Vol. 48, Section B, No. 11: Granitisation of Hornfelsed Sediments in the Newry Granodiorite of Goraghwood Quarry, Co. Armagh. By Doris L. Reynolds. Pp. 231–268. 3s. (Dublin: Hodges, Figgis and Co., Ltd.; London: Williams and Norgate, Ltd.) [18

Ministry of Fuel and Power: Committee on the Efficient Use of Fuel. Fuel Efficiency Bulletin No. 9: Combustible Material in Ashes. Pp. ii+10. Fuel Efficiency Bulletin No. 10: Control of Excess Air on Steam Raising and Central Heating Plants. Pp. 12. (London: Ministry of Fuel and Power.) [33

The Super Church: a New Church, a New Bible and a New Reformation for a New World; a Challenge to Religious and Anti-Religious Diehards. By W. Margrie. Pp. 32. (London: The Author, 65 Trafalgar Avenue, S.E.15.) 6d. [19

A Post-War Agricultural Policy for Great Britain. A Memorandum prepared by a Group of Peers holding varied Political Creeds. Pp. 16. (London: Vacher and Sons, Ltd.) [33

Other Countries

Proceedings of the United States National Museum. Vol. 92, No. 3152: The Fresh-water Fishes of Liberia. By Leonard P. Schultz. Pp. 301–348+plates 35–36. (Washington, D.C.: Government Printing Office.) [192

Smithsonian Institution: Bureau of American Ethnology. Bulletin 134: The Native Tribes of Eastern Bolivia and Western Matto Grosso. By Alfred Métraux. Pp. ix+182+5 plates. 35 cents. Bulletin 135: Origin Myth of Acoma and other Records. By Matthew W. Stirling. Pp. viii+123+17 plates. 35 cents. (Washington, D.C.: Government Printing Office.) [223

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